Trends in air temperature, total precipitation, and streamflow characteristics in eastern Canada

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ABSTRACT

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Climatological variables such as air temperature and precipitation greatly influence streamflow dynamics including annual flow rates, timing and magnitude of seasonal flows, and the extent and timing of the ice cover period. In turn, changes in these hydrologic variables can greatly influence the ecology of rivers and estuarine areas. The Aquatic Climate Change Adaptation Services Program (ACCASP) is a Fisheries and Oceans Canada initiative to identify and develop responses to potential climate change impacts on Canada's oceans and inland waters. As a part of the Atlantic Basin Risk Assessment component of ACCASP, this study assessed trends in climatic and hydrologic variables across eastern Canada during the 20th century. Air temperature and total precipitation trends were determined for stations in Québec, New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. We found consistent, widespread increasing trends in annual mean temperature across all time periods. Further, we determined that seasonal mean temperatures also showed increasing trends, although rates of change and the spatial extent of change varied depending on time scale. Patterns in total precipitation were less dramatic and less seasonally / spatially consistent than for air temperature. From 1951 – 2010, total annual precipitation did increase in parts of Atlantic Canada. This trend was also apparent on the 110 year time scale but not on the 30 year time scale. We identified trends in annual mean streamflow, timing and magnitude of seasonal extreme streamflow, and the duration of the river ice cover period across eastern Canada. The spring freshet occurred earlier across much of Québec and NB from 1950 – 2009. During the same period, magnitudes of summer low flows demonstrated negative trends across much of eastern Canada. From 1980 – 2009, there was a marked decrease in the magnitude of the spring freshet in western Newfoundland that was consistent across stations in that area but did not occur elsewhere. Changes in duration of ice cover were conflicting with two distinct, sub-regional trends: an increase in the number of ice days in Nova Scotia and Newfoundland, and a decreasing trend in New Brunswick and the Gaspé Peninsula. Overall, the trends identified in this study are consistent with those found in previous studies. However this report provides a more detailed assessment of the eastern Canada region and the sub-regional variation which is often overlooked in broader Canadian studies. Additionally, we provide context for how these changes may affect the ecology of river systems.

RÉSUMÉ

Thistle M.E. and Caissie, D. 2013. Trends in air temperature, total precipitation, and streamflow characteristics in eastern Canada. Can. Tech. Rep. Fish. Aquat. Sci. 3018: ix + 97p.

Des variables climatologiques telles que la température de l'air et les précipitations influencent grandement la dynamique de l'écoulement fluvial, y compris les débits annuels, la date et l'amplitude des débits saisonniers, ainsi que l'étendue de la période de couverture de glace en hiver. En revanche, les changements dans ces variables hydrologiques peuvent grandement influencer l'écologie des rivières et des zones estuariennes. Le programme sur les sciences aquatiques en lien avec l'adaptation aux changements climatiques (PSAACC) est une initiative de Pêches et Océans Canada visant à identifier et élaborer des études sur les impacts potentiels des changements climatiques au niveau des océans et des eaux intérieures canadiennes. Dans le cadre de la composante du bassin versant atlantique pour l'évaluation des risques du PSAACC, cette étude a évaluée les tendances des variables climatiques et hydrologiques à l'Est du Canada au cours du 20e siècle. Les tendances de la température de l'air et des précipitations totales ont été déterminées pour des stations au Québec, au Nouveau-Brunswick, en Nouvelle-Écosse, à l'Île du Prince Édouard et à Terre-Neuve-et-Labrador à l'aide des données d'Environnement Canada, Données Climatiques Canadiennes Ajustées et Homogénéisées (DCCAH) pour les plus récentes 30, 60 et 110 années. Nous avons trouvé des tendances à la hausse de la température moyenne annuelle pour l'ensemble des périodes. En outre, nous avons déterminé que les températures moyennes saisonnières ont également montré une tendance croissante, bien que les taux de changement et de l'étendue spatiale du changement varient en fonction de l'échelle de temps. Les tendances au niveau des précipitations totales ont été moins importantes et moins spatialement cohérentes que pour la température de l'air. De 1951 - 2010, les précipitations totales annuelles ont augmenté dans certaines régions du Canada Atlantique. Cette tendance s'est également manifestée sur l'échelle de temps de 110 années. Nous avons identifié des tendances au niveau du débit annuel, de la date et l'amplitude du débit saisonnier extrême, ainsi que sur la durée de la période de couverture des glaces à l'Est du Canada en utilisant les données hydrométrique de HYDAT du Relevés hydrologiques du Canada et du Centre d'expertise hydrique du Québec (CEHQ). La crue printanière a lieu plus tôt dans la majeure partie du Québec et Nouveau-Brunswick de 1950 à 2009. Durant la même période, les débits faibles ont démontré des tendances à la baisse dans la majeure partie de l'Est du Canada. De 1980 - 2009, il y a eu une diminution marquée dans l'amplitude de la crue printanière dans le secteur ouest de Terre-Neuve, mais pas ailleurs. Les changements et tendances dans la durée de la couverture de glace ont été en opposition pour deux régions distinctes: une augmentation du nombre de jours de glace en Nouvelle-Écosse et Terre-Neuve, et une tendance à la baisse au Nouveau-Brunswick et en Gaspésie. Dans l'ensemble, les tendances identifiées dans cette étude sont cohérents avec celles trouvées dans les études précédentes. Toutefois, ce rapport fournit une évaluation plus détaillée de la région de l'Est du Canada et de la variation sous-régionale qui est souvent négligée dans les études du Canada. En outre, nous fournissons de l'information et un contexte expliquant comment ces changements peuvent influer l'écologie des systèmes fluviaux.

1.0 INTRODUCTION

Climate change is currently taking place due to increased concentrations of greenhouse gases in the atmosphere. Since the industrial revolution (mid-18th century), concentrations of naturally occurring and man-made greenhouse gases have increased due to intensified industrial and other anthropogenic activities (IPCC 2007). As a result, the global climate has changed significantly over that past 100 years. Potential consequences of a changing climate have received considerable attention at the national and international levels as such changes can impact many sectors including water resources and aquatic ecosystems. To identify and develop responses to potential climate change impacts on Canada's oceans and inland waters, Fisheries and Oceans Canada launched the Aquatic Climate Change Adaptation Services Program (ACCASP).

In Canadian and global studies (including ACCASP), two levels of analysis have been carried out to better understand and predict our changing climate. These include the simulation of future climate scenarios as well as the study of past trends. In terms of future climate, many simulation studies have been carried out in Canada using projections from Global Circulation Models (GCMs). In eastern Canada, results are generally showing an increase in both air temperature and precipitation (Swansburg *et al.* 2004, Boyer *et al.* 2010, Turkkan *et al.* 2011). As shown by these studies, the level of change largely depends on the Global Circulation Model (GCM) as well the emission scenarios. However, it is clear form most studies that the level of uncertainty and variability is higher in precipitation than in air temperature projections. For example, Boyer *et al.* (2010) studied three different GCMs (HadCM3, CSIRO-Mk2 and ECHAM4) and two emission scenarios (A2 and B2). In this study, larger differences were noted in the projected seasonal precipitation among the different GCMs whereas most models showed similar increases in air temperature (~ 2-6°C) over the next 100 years.

Many climate change studies also include the analyses of past trends, as these trends can be informative for future short-term changes (*e.g.* next 10-15 years). Such

analyses have shown that the past climate has experienced significant change in air temperature, precipitation, hydrologic regime as well as in snow and ice conditions (Zhang *et al.* 2011). The study by Zhang *et al.* (2011) showed an average increase in air temperature of 1.4°C in Canada (1950-2007), with the highest increases reported in western Canada (> 1.5°C). Precipitation (total) across Canada also showed an increase, especially in the north; however, eastern Canada showed a mix of increases and non significant trends. Another related study showed increases in annual rainfall of about 12.5% in Canada (Mekis and Vincent 2011; 1950-2009). Most significant increases were observed in the spring and autumn. This study also looked at trends for southern Canada (where most long-term data are confined) and observed an increase of 8.7% in annual rainfall between 1900 and 2009. When studying extreme temperatures in Canada over the past century, studies have shown fewer cold nights and cold days as well as more warm nights and warm days (Bonsal *et al.* 2001, Vincent and Mekis 2006). More days with precipitation were also observed. With increasing air temperature, studies have shown that winter and spring snow depths have generally decreased throughout much of Canada during the period of 1946 to 1995 (Brown and Braaten 1998). In recent studies, similar trends of decreasing duration of the snow and ice cover were observed across Canada (Brown and Mote 2009, Zhang *et al.* 2011) as more precipitation is falling in the form of rain.

Changes in temperature and precipitation have resulted in changing hydrologic regimes in many parts of the world (Miller *et al.* 2003, Assani *et al.* 2011) and future climate is also expected to result in further changes (Whitfield *et al.* 2003, Ryu *et al.* 2011). Trends in hydrologic time series have not always been clear within the literature when it comes to changes in magnitude (mean flow, floods and low flows); however, there has been more evidence of a timing shifting, especially for snowmelt dominated rivers (Nohara *et al.* 2006). For instance, Lins and Slack (1999) have studied trends in 395 stations across the continental USA for periods ranging between 30 and 80 years (1914-1993). High flows generally remained unchanged whereas low flows generally increased over various time periods. In Canada, the study of Whitfield and Cannon

(2000) show that many Canadian rivers are generally classified into three different categories; 1) snowmelt dominated, 2) rainfall dominated (coastal BC) and 3) a mix of snowmelt and rainfall (southern Ontario and Nova Scotia). Over a period of two decades, this study showed that as temperature is increasing, streams are responding with a shift of earlier spring high flows.

Despite a growing body of literature on past, current, and potential impacts of a changing climate, most studies address trends over large areas and provide 'nation-wide' estimates. Given the spatial extent of Canada, there is a need for more intensive studies over smaller regions. As part of the Atlantic Basin Risk Assessment component of ACCASP, this study assessed trends in climatic and hydrologic variables across eastern Canada during the 20th century. For this study we investigated two climatic parameters – air temperature and total precipitation. Both of these parameters were analyzed annually and on a seasonal basis. We also investigated four hydrological parameters, namely the mean annual discharge, streamflow (discharge) timing and magnitude of extreme flow events (analyzed over specific periods), and occurrence of river ice to assess the evidence and potential impacts of climate change in eastern Canada.

2.0 MATERIALS AND METHODS

2.1 Air Temperature

Air temperature data were obtained from Environment Canada's database of 'Adjusted and Homogenized Canadian Climate Data' (AHCCD) (Environment Canada 2012). These data have been collected at several climatological stations across Canada and have been corrected for changes in station location, observing practices and automation, to permit more reliable assessment of possible climatic shifts (Vincent *et al.* 2009, Environment Canada 2012). Using the AHCCD database, we assessed changes in the annual, winter (December, January, February), spring (March, April, May), summer (June, July, August), and autumn (September, October, November) mean temperatures. Within the AHCCD database, annual and seasonal mean

temperatures were computed from daily mean temperatures, which were in turn estimated from the average of daily minimum and maximum temperatures. Annual and seasonal means were only computed in years and seasons for which there was a complete data set.

We selected sites across eastern Canada (Québec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador) on the basis of the spatial distribution of the stations across the different provinces, the duration of record keeping at the stations, and the quality of data (Table 1). Table 1 provides the site location, station number, the province as well as the length of record within each study period. Data quality was largely determined by the completeness of the 'annual means' field over the entire dataset, the past 60 years, and the past 30 years. Effort was made to include stations at northern latitudes, even if data quality was not ideal, due to the limited number of stations in Canada's North and its potential sensitivity to climatic changes.

2.2 Total Precipitation

Total precipitation data for eastern Canada were obtained from Environment Canada's AHCCD database. As for air temperature, these data have been adjusted and account for differences in rain gauge and snow ruler type, wind undercatch, evaporation, and the occurrence of trace precipitation, as well as the relocation or joining of stations (Mekis and Vincent 2011; Environment Canada 2012). For this study, we assessed changes in annual and seasonal (as above) total precipitation. Within the AHCCD database, total precipitation is determined by adding the station's daily adjusted rain and snow observations and is expressed in mm. Annual and seasonal totals were only computed in years and seasons for which there was a complete data set.

Site selection for precipitation data was governed by the same logic as for the air temperature stations (Table 2). Table 2 provides the site location, station number, the province as well as the length of record within each study period. When possible, we

selected the same climatological stations for both the air temperature and total precipitation analyses. When differences in data quality didn't allow this, we selected nearby sites to maintain a similar sampling effort and spatial distribution.

2.3 Streamflow

Data on streamflow or river discharge were obtained from two sources. Data for New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador were obtained from the Water Survey of Canada's online HYDAT database (Environment Canada 2011). HYDAT provides water information gathered by the National Hydrometric Program for over 2500 active and 5500 retired hydrometric stations across Canada. Data for Québec stations were obtained from the Centre d'expertise hydrique du Québec (CEHQ) database of hydrometric data (Gouvernement du Québec 2012), which provides historical and instantaneous flow data for approximately 650 stations. Stations were selected on the basis of spatial distribution, length of data record, and completeness of record (Table 3). As with the air temperature and precipitation stations, effort was made to include stations at northern latitudes, even if data quality was not ideal. Stations that best represented the location and distribution of the climatological stations were selected. Further, while we attempted to select rivers that were not regulated, we did include stations on prominent rivers within regions and a few stations are regulated. Stations across a wide range of drainage areas were selected (Table 3). Table 3 show the station number, the river name and province, site location, the drainage basin size and if the station is regulated or not as well as the length of record.

For both datasets, daily mean flow data were used to calculate annual mean flows, seasonal extremes, timing of seasonal extremes, and duration of ice cover. For stations where data collection began prior to January 1, 1950, the data record was truncated to start on this date. For sites which were established after this date, the first date of recorded data was the beginning of our datasets. We calculated values for

hydrometric variables per 'hydrologic year' in order to assess the impact of over-winter precipitation on runoff and flow dynamics. A hydrologic year was defined as beginning on day 273 (October 1 in non-leap years). To create a continuous numerical sequence of days throughout a hydrologic year, days prior to January 1 were assigned negative day values (December 31 = 0, December 30 = -1, December 29 = -2,...). Therefore, within a hydrologic year, 'hydrologic days' ranged from -90 to 273. Hydrologic years were numbered for the autumn in which they began. For example, hydrologic year 1949-50 began on October 1, 1949 and ended September 30, 1950.

2.3.1 Annual Mean Discharge

Annual mean discharge for each station was computed from daily mean flows and was based on hydrologic years. Annual mean discharge values were included in the analysis if daily flows had been recorded for at least 95% of the hydrologic year.

2.3.2 Magnitude and Timing of Seasonal Extreme Flows

For each streamflow station, we examined changes in the timing and magnitude of three seasonal extremes: spring maximum flow, summer minimum flow, and winter minimum flow. To assess these extremes, we defined the seasons based on the mean annual hydrograph for each site (Table 4). Note that low flow seasons (winter and summer) can overlap with the spring high flow season. This site-specific approach was needed as the stations covered a range of latitudes and longitudes and a single seasonal definition was not appropriate (*e.g.* the spring period occurs earlier in the south, the summer period is shorter in the north). Table 4 provides the station number, the province as well as the start and end of each season. For instance, winter began in December of a hydrologic year and extended until the mean daily hydrograph began to peak in early spring. Spring ranged from day 50 until the peak in the hydrograph had returned to base levels, to reduce the likelihood of including any summer rainstorm

flood events. Summer was defined for each site as beginning shortly after the spring peak and extending until the end of the hydrologic year.

For each year, seasonal extremes were identified by calculating running mean daily flows for 30-day periods within each season. The timing of the seasonal extreme (minimum or maximum) was attributed to the last day of the 30-day period. Because of missing data within the datasets, a seasonal extreme was only calculated for years in which daily flow values were recorded for more than 95% of the length of that season.

2.3.3 Duration of Ice Period

Both the HYDAT database and the CEHQ database adjust daily flow values to reflect known irregularities in measurement techniques or river conditions. One of these adjustments accounts for the backwater effect of ice presence on a river. The backwater effect is when the water level is influenced by ice conditions (e.g. ice cover) and need to be adjusted to calculate the river discharge. Adjustments made for backwater effects are denoted in the databases, and therefore can be used as indicators of ice cover (Brimley and Freeman 1997). The backwater correction became part of the hydrometric record in 1955 in Nova Scotia and Newfoundland rivers (Brimley and Freeman 1997), and therefore trends in ice cover were only assessed after this date. For each year, we summed the number of times a backwater adjustment was made at a station as an estimate of the number of days with ice. To account for bias introduced from missing data, we only computed the total number of ice days for years in which daily flow values were recorded for more than 95% of the length of the winter season.

2.4 Analysis of Temperature, Precipitation and Streamflow Data

Annual and seasonal trends in mean temperature, total precipitation, annual mean streamflow, seasonal extreme flow timing and magnitude, as well as the number of ice days were assessed using linear models in R version 2.14.2 (R Development Core

Team 2011) and the Diagnostic Checking in Regression Relationships (lmtest) package (Zeileis and Hothorn 2002). Linear changes in mean temperature and total precipitation were assessed for each station and were computed for three time periods: 1) the entire period over which data were collected, 2) the past sixty (60) years (1951 – 2010), and 3) the past thirty (30) years (1981 – 2010). We also computed trends for the 1900 – 2010 period for stations with more than 90 years of data. Linear changes for the hydrometric variables were assessed for each station over two time periods: the past sixty hydrologic years (1950 – 2009), and the past thirty hydrologic years (1980 – 2009). Residuals from each linear model were examined for homogeneity, normality, and independence by evaluating plots of the residuals against fitted values, frequency distribution of the residuals, and the Durbin-Watson test for autocorrelation of disturbances, respectively. If a fitted linear model violated the assumptions of homogeneity, normality, and/or independence of variance, and if the p-value was between 0.01 and 0.09, we re-evaluated the relationship using a generalized linear model with a gamma error structure and an identity link (nlme package also available in R, Pinheiro *et al.* 2012). If the assumptions were violated and the p-value was < 0.01 or > 0.09, we assumed that reassessment using an alternate model would be unlikely to change the decision of significance. In all cases, the criterion for significance was $p < 0.05$. In this study, a 'trend' refers only to a change over time (slope) which is significantly different from zero.

For each station, significant changes in mean temperatures, total precipitation, and the hydrological variables over time were reported as slopes with a 95% confidence interval. To visualize patterns in these changes across eastern Canada, we mapped the trends using R version 2.14.2 (R Development Core Team 2011) and the package (maptools) (Lewin-Koh *et al.* 2012). Changes in temperature were expressed as 'temperature change (°C) per decade'. Changes in total precipitation were expressed as 'percent change per decade' to account for inherent variability in precipitation between sites. Similarly, changes in magnitude of annual mean flow or seasonal extreme flows were expressed as 'percent change per decade'. Changes in timing of seasonal extreme

flows and total number of ice days were expressed as 'days per decade'. Inter-seasonal differences in mean rates of change were analyzed via repeated measures ANOVA and post-hoc Tukey's tests in Minitab 16 Statistical Software (2010).

3.0 RESULTS AND DISCUSSION

Linear trends, parameter estimates, and p-values for all analyses (air temperature, total precipitation, and streamflow dynamics) and all stations were presented in Appendix A. Figures of trends are presented in Appendix B (not part of the present report, for brevity, but available upon request).

3.1 Air Temperature Trends

To assess changes in air temperature, we identified 37 stations which met our criteria of data quality, record longevity, and spatial distribution (Fig. 1). These stations were used in our 30 and 60 year analyses and represented all 5 eastern Canadian provinces: 15 Québec stations, 6 New Brunswick stations, 6 Nova Scotia stations, 1 Prince Edward Island station, and 9 Newfoundland and Labrador stations (Table 1). Twenty-three of these 37 stations were also used to identify trends over the longer time period of 1900 – 2010.

Linear trends were assessed for each station and results are shown for the Chatham – Miramichi station (Fig. 2 - annual; Fig. 3 – seasonal). The results were categorized according to the magnitude of change, and mapped to help elucidate spatial patterns across eastern Canada. Significant increases in annual mean air temperature were observed at all 3 time scales (30, 60, and 110 years) across the entire region (Figs. 4 & 5). Over the past 60 years (Fig. 4A), increases across the Maritime Provinces and Québec ranged from 0.1 – 0.6 °C per decade. Significant changes were less apparent across the island of Newfoundland on this time scale. A previous study (Zhang *et al.* 2011) found comparable rates of warming in eastern Canada over a similar time frame (1950 – 2007), however our analysis reveals more significant trends in the Maritimes

than identified by Zhang *et al.* (2011). Rates of change appear more dramatic over the 30 year time frame (Fig. 4B) as compared to the 60-year period and are significant throughout Newfoundland and Labrador on this shorter time scale. A number of factors could drive these patterns. At many stations, annual mean air temperatures after ~ 2000 are, on average, higher than those recorded in the earlier part of the 30-year period or temperatures recorded prior to 1980. For these sites, including primarily stations in New Brunswick and the Gaspé Region of Québec, the observed increased warming rate since 1980 may represent an augmented anthropogenic effect on climate in the later portion of the 20th century (IPCC 2007), however more data is required to determine if the observed trend will persist in future years or if it is an anomaly over a broader time scale. At some sites, a higher rate of warming from 1981 – 2010 appears to be driven by a relatively cold period in the early 1990s, followed by a return to historically comparable annual mean temperatures in the mid 1990s. Sites affected by this pattern occur across Newfoundland and Labrador, in northern Québec, and to a lesser degree on the northern shore of the Gulf of St. Lawrence.

Analysis of trends over 30-year and 60-year time frames revealed that detection, degree and direction of significant trends were largely influenced by when and for how long one assessed changes in air temperature. To determine whether or not the observed trends and spatial patterns held over a longer time period, we analyzed data from a subset of stations from 1900 – 2010 (Fig. 5). The Maritime Provinces and southern Québec were well represented in this subset, however only 1 northern Québec site and 2 sites from Newfoundland had sufficient record length to be included in the analysis. Increasing air temperature patterns were consistent across the region on the 110 year time frame. The rate of change was less than those found for either the 60-year or 30-year period and were generally in the range of <0.09 °C to 0.3 °C per decade. This analysis demonstrates that significant and consistent warming, as estimated by change in annual mean temperature, has occurred throughout eastern Canada since the end of the 19th century. Importantly, it shows that the patterns observed over the more recent

time frames are representative of a larger trend and are not a result of inter-decadal variation exacerbated by random time period selection.

Annual mean air temperature is a useful metric to study coarse scale changes in climate, however important and informative changes may be occurring at the seasonal scale. Trends in seasonal air temperature may drive the observed annual pattern, or alternatively, could be masked by the annual means. Further, season specific trends may affect hydrological and biological processes more directly than those based on annual means. For these reasons, we examined trends in mean seasonal air temperatures over the same 30, 60, and 110-year time scales. Figure 3 is an example of such seasonal analysis for the Chatham – Miramichi station. Increasing trends in air temperature measured over the 60-year period were observed across all seasons (Fig. 6). These patterns were widespread across eastern Canada during summer, but were more regional in spring (Maritimes) and autumn (Newfoundland and Labrador, northern and eastern Québec, northern New Brunswick). There were fewer significant trends in winter, and no recognizable spatial pattern. In addition, the average rate of warming across the region from 1951 – 2010 was greater in summer than in the other seasons (Table 5). The summer and winter patterns in this study are consistent with previous analyses (Zhang *et al.* 2011), however our work is the first to demonstrate significant, regional warming patterns in eastern Canada during spring and fall seasons.

Like the mean annual temperature trends, changes in mean seasonal temperatures appeared more dramatic for the 30-year analyses than those measured over 60 years (Fig. 7). From 1981 – 2010, widespread and increasing temperature trends were present during summer, autumn, and winter seasons. Mean rates of temperature change for each of these seasons were significantly higher than the mean rate of change for spring, which showed few significant trends and no clear spatial pattern (Table 5). Although changes in winter temperatures appear most dramatic – northern regions warmed at > 1.0 °C per decade and many other stations increased by 0.6 – 1.0 °C per decade – the overall mean change in average winter temperature in eastern Canada was not different from either autumn or summer due to many stations in the Maritimes

displaying no significant change over the past 30 years. Our observations of high warming rates at northern stations is consistent with other studies which have suggested through modeling (IPCC 2007, Woo *et al.* 2008) and demonstrated via observation (IPCC 2001, Vincent and Mekis 2006) that higher latitudes are experiencing the effects of climate change at a faster rate than more southern regions. It should be noted that the northern stations which show a winter warming rate of > 1.0 °C per decade over the past 30 years are the same sites which experienced colder than average temperatures during the early 1990s, and therefore these high rates may be a function of a short-term climatic anomaly. Trends measured from 1900 – 2010 show some combination of the patterns observed over the past 30 and 60 years (Fig. 8) with some warming across the region (up to 0.3 °C per decade) and some seasonal differences. At this time scale, mean increases in temperature were greater in winter than in autumn but not different from either spring or summer trends (Table 5).

3.2 Total Precipitation Trends

We identified 35 stations across eastern Canada suitable for analyzing trends in total precipitation over the past 30 and 60 years (Fig. 1). Stations were distributed across eastern Canada (13 Québec, 6 New Brunswick, 6 Nova Scotia, 1 Prince Edward Island, and 9 Newfoundland and Labrador stations). Nineteen of these 35 stations were used to assess trends over the longer 1900 – 2010 time period. For each station, linear trends were calculated for total annual and seasonal precipitation. Figure 9 (annual) and Figure 10 (seasonal) show an example of such results for the Moncton station (see Appendix A and Appendix B for other stations). Similar to air temperature, results were then categorized according to magnitude of change, and mapped to allow visualization of spatial patterns.

In general, trends in total precipitation were less apparent across all time scales and all seasons than trends for mean air temperature. There are few significant or consistent trends in total annual precipitation when assessed over the past 30 years (Fig.

11B). However over the longer time periods, spatial patterns of significant trends do emerge. Over the past 60 years, total annual precipitation at stations on the Gaspé Peninsula, Iles de la Madeleine, and Newfoundland significantly increased by up to 10% per decade, comparable to previous reports (Mekis and Vincent 2011, Zhang *et al.* 2011). Over the longer 110 year period, that spatial pattern broadened to encompass more of the Maritime Provinces and southern Québec (Fig. 12) and the rate of change appears constant (~ 5-10 % per decade).

The lack of significant trends or spatial patterns in annual total precipitation over the most recent 30 years appears to conceal two conflicting seasonal trends in the Maritimes for that time frame (Fig. 14). From 1981-2010, some stations showed a significant decrease in total precipitation during winter months, but the region demonstrated a significant increase in precipitation during the fall (Table 5). We found a similar increase in fall precipitation in the 60-year time frame (Fig. 13) throughout Atlantic Canada, and increasing trends for Newfoundland and the Gaspé Peninsula during the spring season. Overall, however, regional mean increases were only observed in autumn when compared to summer and winter (Table 5). There was no significant difference between mean change in spring precipitation and any other season during this period (Table 5). Previous studies have noted similar spatial patterns for fall and spring total precipitation (Zhang *et al.* 2011) and studies of rainfall and snowfall separately (Mekis and Vincent 2011). Over the 110-year time scale, increases in total precipitation are apparent throughout Atlantic Canada during the winter, spring, and autumn seasons (Fig. 15) with no seasonal differences (Table 5). This study provides further evidence that eastern Canada experienced an increasingly wetter climate during the 20th century (Zhang *et al.* 2001b, Mekis and Vincent 2011, Zhang *et al.* 2011).

3.3 Streamflow Trends

Forty-two (42) stations across eastern Canada were selected for analyzing trends in streamflow characteristics over the past 30 and 60 hydrologic years (Fig. 1). There

were 17 Québec, 6 New Brunswick, 6 Nova Scotia, 2 Prince Edward Island, and 11 Newfoundland and Labrador stations selected. We assessed changes in four streamflow characteristics at these sites – annual mean discharge, timing of extreme seasonal flows, magnitude of extreme seasonal flows, and the duration of the ice cover period. For each variable, changes over time were calculated and tested for significance (examples in Figs. 16, 18, 20, 22 respectively; see Appendix A and Appendix B for other stations), categorized in terms of magnitude, and mapped for visual identification of spatial patterns.

3.3.1 Annual Mean Discharge Trends

Annual mean discharge did not change significantly for the majority of streamflow stations when measured from 1950 – 2009 or from 1980 – 2009 (Fig. 17). From 1950 – 2009, 7 stations had significant trends in annual mean discharge: 6 negative trends and 1 positive. The sole positive trend (detectable at both the 60 and 30 year time frame) occurs at Exploits River, NL, a regulated river in central Newfoundland. In 2002 – 2003, the hydro facility at Bishop's Falls, Exploits River, was upgraded and its power generation/flow regime was modified (Scruton *et al.* 2008). The increasing trend at this station is entirely due to this change. The other six sites demonstrate negative trends and are located between 50 °N and 60 °N latitude (5 in Québec and 1 in Newfoundland). The density of stations at these latitudes is low compared to more southern stations in Québec and the Maritimes. Therefore, it is difficult to determine if this 'concentration' of negative trends is representative of the entire area or not. Other studies have suggested negative trends in annual mean discharge in eastern Canada over the later half of the 20th century (Yue *et al.* 2003, Zhang *et al.* 2001a) however in both cases the time frames and analytical approaches differed from those used here. The more striking similarity among Yue *et al.* (2003), Zhang *et al.* (2001a), and this study is the dominance of *non significant* trends across the region, regardless of time scale or statistical technique. This suggests that perhaps

the slight increase in total annual precipitation observed at a few site is not apparent in annual mean discharge trends. The insensitivity of annual mean discharge may result from factors such as: 1) high interannual variability, dependent upon several complex factors which are themselves highly variable, e.g. increased evapotranspiration, or 2) changes in the temporal distribution of streamflow throughout the year not resulting in different annual means over time.

To try and tease apart some of the finer responses that may be masked by a measure of annual mean discharge we examined the timing and magnitude of seasonal extreme flow events, including winter and summer minimum flow periods (drought) and spring maximum flow (freshet).

3.3.2 Trends in Timing of Seasonal Extreme Flows

Few significant trends and no obvious spatial patterns were observed for timing of winter or summer minimum flow events in either the 1950 - 2009 or 1980 - 2009 time frames (Fig. 19). Contrary to these results, Ehsanzadeh and Adamowski (2007) found that both winter and summer low flow periods had advanced in the Atlantic Provinces using a seven-day low flow index to assess changes in timing. The timing of the spring maximum flow period did significantly decrease (start earlier in the year) across a large portion of eastern Canada, at an average rate of ~ 3 days per decade from 1950 – 2009 (Fig. 19). This spatial pattern was apparent throughout Québec, and New Brunswick, but was not visible in Nova Scotia or the island of Newfoundland. No significant changes in spring flow timing were evident at any of the study sites on the 30 year time scale. Previous studies have also suggested an earlier occurrence of the spring freshet, in this region, and across Canada (Zhang *et al.* 2001a). Zhang *et al.* (2001a) claimed that the spring freshet season had advanced by over a month in many Canadian basins from 1947 – 1996 (or ~ 6 days per decade). The change observed by Zhang *et al.* (2001a) was strongest in western Canada, which may explain the higher mean rate of change found in their results as compared to the present study. Rood *et al.*

(2008) also found evidence for earlier spring freshet in rivers draining the Rocky Mountain hydrographic apex region. Burn and Hag Elnur (2002) alluded to earlier annual flood events in the Atlantic region and the North East Forest region which includes Québec and Labrador, although they did not measure spring flood timing specifically. Further, the advanced timing of the spring flood detected in previous studies and documented here is consistent with global climate model projections computed for boreal regions of Canada (Woo *et al.* 2008).

3.3.3 Trends in Magnitude of Seasonal Extreme Flows

Trends in magnitude of seasonal extreme flows varied spatially and temporally across both season and time frame (past 60 years or past 30 years) (Figure 21). Winter minimum flows have largely remained unchanged over the past 60 and 30 years, as most stations demonstrated no significant change in the lowest flow period of the winter. Five of 42 stations in each time period did show a large (more than 10% per decade) significant increase in flow during the winter period, however these results must be interpreted carefully. In both the 60-year and 30-year time frame, 3 of the 6 stations showing an increase in winter low flows are from regulated rivers. Streamflow regulation can modify natural discharge cycles in a number of ways. In some scenarios, winter flows are elevated in accordance with demand for hydro-electric power (Woo *et al.* 2008) which may be the case in rivers such as the Exploits (NL) and Churchill (NL). Winter low flows are expected to increase across Canada as warmer winter temperatures result in more winter rainfall, less persistent river ice formation, and intermittent winter melt (Woo *et al.* 2008).

There is some indication of a reduced maximum spring flow from 1950 – 2009 across northern latitudes (> 50 °N) of eastern Canada (8 of 42 stations) however the paucity of stations in this region limits our ability to interpret these findings. Throughout the Maritime Provinces and most of Newfoundland, there was no significant change in maximum spring flow over this period. From 1981 – 2010, almost

all streamflow stations showed no significant change in spring maximum flow, with the exception of four stations along the west coast of the island of Newfoundland. This highly concentrated effect does not appear to be driven by a change in winter or spring precipitation over the same timeframe/area, however these un-regulated, small-medium rivers (600-2100 km^2 catchment areas) did show large reductions (>10% per decade) in spring freshet which may warrant further investigation.

The broadest and most consistent pattern in seasonal flow extremes was observed for summer low flows, measured from 1950 – 2009. During this period, 10 of the 42 stations had significant decreases in the magnitude of summer low flow periods (*i.e.* lower summer lows). These stations were primarily in northern Québec and Labrador, and few significant trends were observed in the Maritimes, the island of Newfoundland, or southern Québec. Significant decreases in summer low flows have also been found in Canadian rivers in western Canada, particularly rivers whose dynamics are dominated by snow melt (Leith and Whitfield 1998, Rood *et al.* 2008). In contrast, no significant change in summer lows were found in rivers in New England (Hodgkins *et al.* 2005) which, like southern Québec, southern Ontario, and the Maritimes, are less dependent on snowmelt runoff for summer streamflows (Whitfield and Cannon 2000).

3.3.4 Duration of Ice Trends

Like other streamflow characteristics, trends in the number of days with ice present are variable in space and time. An example of the ice duration analysis for the Little Southwest Miramichi River is presented in Figure 22 (results for other stations are in Appendix A and B). From 1950 – 2009, two distinct spatial patterns emerged. Streamflow stations in New Brunswick and on the Gaspé Peninsula demonstrated a significant decrease in the number of days per year with river ice at an average rate of ~ 6 days per decade (Fig. 23). Contrary to this, the number of ice days per year on Nova Scotia and Newfoundland rivers significantly increased at an average

rate of ~ 8 days per decade. Stations in Québec and Labrador showed few significant or spatially consistent trends. Previous studies have found similar trends in the number of days with ice in Atlantic Canada (Brimley and Freeman 1997, Zhang *et al.* 2001a, Burn and Hag Elnur 2002). Brimley and Freeman (1997) noted a dramatic increase in the river ice period in Nova Scotia and Newfoundland rivers, at a rate of up to + 3 days per year. Differences between eastern and western Atlantic Canada trends have also been documented (Zhang *et al.* 2001a, Burn and Hag Elnur 2002), however our study is the first to demonstrate significant and consistent decreases across several stations in New Brunswick and the Gaspé region. Burn and Hag Elnur (2002) found a significant decrease in the ice cover period in the Great Lakes/St. Lawrence River region, adjacent to New Brunswick and the Gaspé, suggestive of a more continental response. The increase in ice cover observed in eastern Atlantic Canada may be related to streamflow conditions and precipitation patterns in this region (Prowse and Beltaos 2002).

The strong spatial patterns in the river ice cover period observed from 1950 – 2009 are not as apparent when assessed over the past 30 hydrologic years, particularly in eastern Atlantic Canada. This suggests that either the past 30 years have been more variable or that the rate of increase observed over the 60-year period has leveled off. There is some indication of a dramatic increase in the ice cover period in northwestern Québec between 1980 – 2009. This seems counterintuitive as the same region shows evidence of increased autumn and winter temperatures over the same time frame. No other studies were found that have investigated streamflow dynamics for this timescale, so comparison to the literature is not possible. In some instances, these dramatic rates of change seem to result from missing data in recent years and/or the presences of 'zero ice day' years in the early 1980s. It should be noted that our measure of ice days is inferred from the use of a streamflow correction factor. If the correction factor was not made, or was not noted in the dataset, it was interpreted as 'no ice present', which may or may not reflect the actual ice conditions at the hydrologic stations. This dataset, although it has been used in past studies, is likely to contain some level of uncertainty

that may prevent a true assessment of trends in river ice cover over the long-term. As such, these results should be interpreted with caution.

3.4 Integrating Climatological and Hydrological Trends – Impacts on River Ecology

Climatological variables such as air temperature and precipitation greatly influence streamflow dynamics including annual flow rates, timing and magnitude of seasonal flows, and the extent and timing of the ice cover period. In turn, changes in these hydrologic variables can greatly influence the ecology of rivers and estuarine areas. An integrated understanding of changes in climatological and hydrological variables is required in order to identify potential risks to river systems.

A trend towards earlier spring freshets was identified for much of eastern Canada for the 1950 – 2009 period. An earlier freshet can result from several contributing factors including warmer autumn, winter and spring temperatures, and potentially an increase in the proportion of winter precipitation falling as rain. An earlier freshet and milder winter could also mean more ice-breakup events in winter. In addition to an earlier spring freshet, these changes can reduce the magnitude of the spring flood as there is a shift towards gradual and intermittent melting and away from a large pulse of snow-melt input (Woo *et al.* 2008). A reduced spring freshet may result in a longer period of summer low flow recession (Hodgkins *et al.* 2005, Rood *et al.* 2008). This, combined with higher summer temperatures and a concomitant increase in evaporation rates, would ultimately result in decreased summer streamflows.

At present, we have found some evidence for these effects in our dataset and using our analysis. Autumn mean temperatures did increase over this time period throughout much of the region, but trends in mean winter and spring temperature were more localized at this time scale. Our analysis did not look at other important temperature trends (*e.g.* frequency of very cold days or nights, seasonal temperature range, or variance in mean temperatures) however other studies have (*e.g.* Zhang *et al.* 2001b, Vincent and Mekis 2006). Likewise, our measure of precipitation does not

distinguish rain from snowfall. Zhang *et al.* (2011) did find a reduction in the number of snow days from 1950 – 2007 through much of eastern Canada, however trends in total amount of snowfall (Mekis and Vincent 2011) and the proportion of precipitation falling as snow (Vincent and Mekis 2006) varied across the region. For the 1950 – 2009 period, we identified limited significant negative trends in spring flood magnitude, however much stronger spatial patterns emerged for reduced summer low flows and increased summer mean temperatures.

What might these climatological and hydrological changes mean for the ecology of river systems in eastern Canada? Changes in air temperature are strongly correlated to changes in stream temperature (Caissie *et al.* 2004, Caissie 2006) and as such can serve as a good proxy for temperature patterns in rivers, particularly in wide and shallow rivers. The physiology, behaviour, and distribution of animals – particularly for aquatic ectotherms – are highly influenced by temperature (*e.g.* Fry 1958, Magnuson *et al.* 1979). As such, changes in environmental temperature can directly and indirectly affect an individuals' fitness as well as the health of populations (see Pörtner and Farrell 2008). Temperature directly affects the metabolic rate and aerobic scope of animals such as fish. Increased water temperatures reduce the oxygen holding capacity of water and increase rates of physiological reactions. As such, warmer temperatures restrict the energy available to actively defend territories, compete for mates, produce gametes, forage, fight infection and depurate toxins. Further, the ability to compensate for increasing temperature changes with size and life-stage. Taken together, the seasonal variability of increasing river temperatures could affect all life-stages of a species at different times in the year, resulting in many 'critical stages' which may be affected by climate change and ultimately change population structure. Indirectly, changes in temperature can shift community and size distributions of prey items for fish, or may alter the seasonal timing of processes such as algal blooms or migrations. These alterations may undermine critical matched species interactions (*e.g.* timing of larvae hatch/emergence and food availability) and have population-scale repercussions (Pörtner and Farrell 2008). For instance, recent studies in the Miramichi River (NB)

show that water temperature can reach over 30°C in summer during some years (Caissie *et al.* 2012). Results from the present study are showing trends of increased summer air temperatures as well as more severe low flows. If these trends continue in the future it is very likely that river water temperature will increase as well, as summer low flow and air temperature are two important parameters that influence river water temperature.

In this study, we also noted an increase in total precipitation across Atlantic Canada on some time scales. Increased precipitation could affect rivers and their biological communities in multiple ways, depending on the distribution of precipitation throughout the year, the occurrence of extreme precipitation events, and whether the precipitation is rain or snow. Increased precipitation in agricultural or highly populated areas could increase flooding, and pesticides, fertilizers, and pollutants runoff into water bodies. This may directly affect biological communities by increasing exposure to harmful toxins/chemicals or may have indirect consequences such as increased eutrophication and subsequent increased biological oxygen demand. Changes in the intensity and frequency of pluvial flood events can also greatly affect biological communities in rivers by altering water chemistry, increasing turbidity, displacing populations, and by modifying habitat and structure. For example, it is well known that intense precipitation is responsible for many high sediment transport events into streams (Waters 1995).

Changes in climatological variables can influence streamflow dynamics in numerous and dramatic ways. Changes in spring freshet timing or magnitude can affect the phenology of plants, bacterial communities and animals within rivers (*e.g.* Crozier *et al.* 2008, Crump *et al.* 2009), on river banks (Rodd *et al.* 2008), and in estuaries (Gillanders *et al.* 2011). Reduced spring floods alter water chemistry and subsequent microbial, primary and secondary production (*e.g.* Crump *et al.* 2009). Reduced summer flows magnify high temperature effects, alter habitat type and availability, and increase densities of some species which can lead to a variety of lethal (e.g. increased predation rates) and sub lethal (e.g. reduced average growth rates, increased rates of infection) consequences. Modified flow dynamics, such as reduced freshwater flow in

the summer or increased freshwater flow in the winter, can alter salinity levels, nutrient imputs, and sedimentation rates in estuaries (Gillanders *et al.* 2011). This in turn can affect community composition, recruitment success, and phytoplankton production in the coastal zone.

A warmer winter may change the number or duration of river freeze/thaw events thereby also impacting river communities. Cunjak *et al.* (1998) suggested that Atlantic salmon eggs and parr can be physically damaged or dislocated downstream by 'severe' ice break-ups. Further, the dynamic temperature and hydrologic changes associated with the pre-ice and ice-formation periods may result in increased mortality for juvenile fish via dislocation (Linnansaari and Cunjak 2010) or increased metabolic demands. Increasing winter water temperatures and more frequent freeze-thaw periods may place additional stresses on juvenile fish in a future warming climate.

4.0 SUMMARY AND CONCLUSIONS

This study adds to the increasing evidence of a changing climate over the 20th century. Trends in air temperature, precipitation, and streamflow characteristics in eastern Canada demonstrate that, although spatially and temporally variable, our climate has generally become warmer and wetter. The broadest and most consistent trends were increases in mean annual and seasonal air temperatures. Trends in total precipitation were more variable than those for air temperature. To help elucidate changes in precipitation, it would be useful to assess changes in snowfall and rainfall separately for eastern Canada. Changes in climatological variables directly influence streamflow dynamics. In this study, we found some evidence of an advancement of the spring freshet, and a decrease in the summer low flows throughout eastern Canada. These observations are consistent with a warming climate in which winter melt is more gradual due to higher temperatures and a change in the rain:snow ratio. If the trends observed in this study continue in accordance with climate change model predictions,

the consequences for eastern Canada river communities and ecology could be important and should be considered as part of an ecosystem approach to fisheries management.

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Table 1: Site and data collection information for stations used in air temperature trend analysis for eastern Canada over the past 30 and 60 years. Stations in italics were also used in the 1900-2010 analysis

Province	Station Number	Station Name	Latitude	Longitude	First Year of Data	Last Year of Data	Length of Record (Years)	Number of Years Used (1951-2010)					Number of Years Used (1981-2010)				
								Annual	Winter	Spring	Summer	Fall	Annual	Winter	Spring	Summer	Fall
NB	*8100300*	*Aroostook*	*46.80*	*-67.70*	*1913*	*2010*	*97*	*46*	*54*	*53*	*49*	*49*	*19*	*24*	*24*	*21*	*24*
NB	*8100503*	*Bathurst*	*47.60*	*-65.80*	*1920*	*2010*	*90*	*46*	*50*	*52*	*57*	*51*	*28*	*29*	*29*	*29*	*28*
NB	*8100989*	*Chatham Miramichi*	*47.00*	*-65.50*	*1873*	*2010*	*137*	*56*	*59*	*59*	*59*	*59*	*26*	*29*	*29*	*29*	*29*
NB	*8101500*	*Fredericton*	*45.90*	*-66.50*	*1871*	*2010*	*139*	*59*	*60*	*59*	*60*	*60*	*30*	*30*	*30*	*30*	*30*
NB	*8103200*	*Moncton*	*46.10*	*-64.70*	*1898*	*2010*	*112*	*60*	*60*	*60*	*60*	*60*	*30*	*30*	*30*	*30*	*30*
NB	*8104900*	*Saint John*	*45.30*	*-65.90*	*1871*	*2010*	*139*	*59*	*58*	*59*	*59*	*59*	*30*	*30*	*30*	*30*	*30*
NL	8401300	Corner Brook	49.00	-58.00	1933	2010	77	54	54	58	58	57	26	26	29	28	27
NL	8401700	Gander	49.00	-54.60	1937	2010	73	60	60	60	60	60	30	30	30	30	30
NL	8402958	Plum Point	51.10	-56.90	1972	2010	38	36	37	36	38	38	28	29	28	30	29
NL	*8402975*	*Port aux Basque*	*47.60*	*-59.00*	*1909*	*2010*	*101*	*49*	*52*	*53*	*51*	*53*	*24*	*27*	*28*	*26*	*27*
NL	*8403506*	*St. John's*	*47.60*	*-52.80*	*1874*	*2010*	*136*	*60*	*60*	*60*	*60*	*60*	*30*	*30*	*30*	*30*	*30*
NL	8501100	Cartwright	53.70	-57.00	1934	2010	76	60	60	60	60	60	30	30	30	30	30
NL	8501900	Goose Bay	53.30	-60.40	1941	2010	69	60	60	60	60	60	30	30	30	30	30
NL	8504175	Wabush Lake	52.90	-66.90	1960	2010	50	48	50	50	49	49	30	30	30	30	30
NL	840C401	St. Anthony	51.40	-55.60	1946	2009	63	47	54	55	53	51	23	26	26	24	25
NS	*8201000*	*Collegeville*	*45.50*	*-62.00*	*1916*	*2009*	*93*	*48*	*52*	*55*	*56*	*55*	*23*	*25*	*26*	*27*	*27*
NS	*8202250*	*Halifax*	*44.70*	*-63.60*	*1871*	*2010*	*139*	*60*	*60*	*60*	*60*	*60*	*30*	*30*	*30*	*30*	*30*
NS	*8204402*	*Parrsboro*	*45.40*	*-64.30*	*1897*	*2010*	*113*	*49*	*53*	*56*	*55*	*54*	*26*	*27*	*27*	*28*	*26*

Table 1: Site and data collection information for stations used in air temperature trend analysis for eastern Canada over the past 30 and 60 years. Stations in italics were also used in the 1900-2010 analysis (continued)

Province	Station Number	Station Name	Latitude	Longitude	First Year of Data	Last Year of Data	Length of Record (Years)	Number of Years Used (1951-2010)					Number of Years Used (1981-2010)				
								Annual	Winter	Spring	Summer	Fall	Annual	Winter	Spring	Summer	Fall
NS	*8204700*	*Sable Island*	*43.90*	*-60.00*	*1897*	*2010*	*113*	*56*	*59*	*59*	*58*	*58*	*26*	*29*	*29*	*28*	*28*
NS	*8205700*	*Sydney*	*46.20*	*-60.10*	*1870*	*2010*	*140*	*60*	*60*	*60*	*60*	*60*	*30*	*30*	*30*	*30*	*30*
NS	*8206500*	*Yarmouth*	*43.80*	*-66.10*	*1879*	*2010*	*131*	*59*	*60*	*60*	*60*	*59*	*30*	*30*	*30*	*30*	*30*
PE	*8300300*	*Charlottetown*	*46.30*	*-63.10*	*1872*	*2010*	*138*	*58*	*60*	*59*	*60*	*59*	*30*	*30*	*30*	*30*	*30*
QC	*7024740*	*Montreal Tavish*	*45.50*	*-73.80*	*1871*	*2010*	*139*	*49*	*54*	*53*	*53*	*55*	*19*	*24*	*24*	*23*	*25*
QC	*7034482*	*Maniwaki*	*46.30*	*-76.00*	*1914*	*2010*	*96*	*51*	*60*	*59*	*54*	*58*	*25*	*30*	*30*	*25*	*30*
QC	*7045401*	*Natashquan*	*50.20*	*-61.80*	*1914*	*2010*	*96*	*52*	*56*	*57*	*59*	*56*	*30*	*30*	*30*	*30*	*30*
QC	7047914	Sept Iles	50.20	-66.30	1944	2010	66	59	60	60	60	59	30	30	30	30	30
QC	*7052605*	*Gaspe*	*48.80*	*-64.50*	*1916*	*2010*	*94*	*41*	*48*	*48*	*47*	*51*	*30*	*30*	*30*	*30*	*30*
QC	*7055120*	*Mont Joli*	*48.60*	*-68.20*	*1875*	*2010*	*135*	*59*	*60*	*60*	*60*	*59*	*30*	*30*	*30*	*30*	*30*
QC	*7060400*	*Bagotville*	*48.30*	*-71.00*	*1880*	*2010*	*130*	*59*	*59*	*60*	*60*	*60*	*30*	*30*	*30*	*30*	*30*
QC	7065639	Normandin	48.90	-72.50	1936	2010	74	53	58	58	56	56	24	28	28	26	27
QC	7098600	Val D'or	48.10	-77.80	1951	2008	57	53	55	57	55	57	27	28	28	27	27
QC	*7103536*	*Kuujjuarapik*	*55.30*	*-77.80*	*1925*	*2010*	*85*	*53*	*57*	*57*	*57*	*55*	*28*	*30*	*30*	*29*	*29*
QC	7113534	Kuujjuaq	58.10	-68.40	1947	2010	63	58	59	59	59	60	30	30	30	30	30
QC	7117825	Schefferville	54.80	-66.80	1948	2010	62	55	57	58	57	56	26	27	28	27	27
QC	*7015001*	*Quebec City*	*46.80*	*-71.40*	*1875*	*2010*	*135*	*59*	*60*	*60*	*60*	*59*	*29*	*30*	*30*	*30*	*29*
QC	705C2G9	Iles de la Madeleine	47.40	-61.80	1933	2010	77	54	54	56	59	58	25	25	27	29	28
QC	7108005	Inukjuak	58.50	-78.10	1921	2010	89	53	54	56	58	57	25	25	27	28	28

Table 2: Site and data collection information for stations used in total precipitation trend analysis for eastern Canada. Stations in italics were used in the 1900-2010 analysis.

Province	Station Number	Station Name	Latitude	Longitude	First Year of Data	Last Year of Data	Length of Record (Years)	Number of Years Used (1951-2010)					Number of Years Used (1981-2010)				
								Annual	Winter	Spring	Summer	Fall	Annual	Winter	Spring	Summer	Fall
NB	8100300	Aroostook	46.80	-67.70	1920	2010	90	47	55	52	51	52	20	25	24	22	24
NB	*8100503*	*Bathurst*	*47.60*	*-65.80*	*1884*	*2010*	*126*	*53*	*58*	*57*	*59*	*56*	*26*	*28*	*29*	*29*	*27*
NB	*8101500*	*Fredericton*	*45.90*	*-66.50*	*1874*	*2010*	*136*	*54*	*55*	*55*	*56*	*55*	*24*	*25*	*25*	*26*	*25*
NB	*8103200*	*Moncton*	*46.10*	*-64.70*	*1898*	*2010*	*112*	*59*	*60*	*60*	*60*	*59*	*29*	*30*	*30*	*30*	*29*
NB	8104400	Rexton	46.67	-64.87	1923	2009	86	50	57	56	58	54	27	29	29	29	27
NB	*8104900*	*Saint John*	*45.30*	*-65.90*	*1871*	*2010*	*139*	*54*	*55*	*55*	*56*	*55*	*24*	*25*	*25*	*26*	*25*
NL	8401300	Corner Brook	49.00	-58.00	1933	2010	77	57	56	59	59	59	28	27	29	29	29
NL	8401700	Gander	49.00	-54.60	1937	2010	73	60	60	60	60	60	30	30	30	30	30
NL	*8402450*	*Isle aux Morts*	*47.58*	*-58.97*	*1909*	*2010*	*101*	*51*	*53*	*54*	*54*	*52*	*21*	*23*	*24*	*24*	*22*
NL	8402958	Plum Point	51.10	-56.90	1972	2010	38	36	37	36	38	38	28	29	28	30	29
NL	*8403506*	*St. John's*	*47.60*	*-52.80*	*1874*	*2010*	*136*	*59*	*60*	*60*	*59*	*60*	*29*	*30*	*30*	*29*	*30*
NL	8501100	Cartwright	53.70	-57.00	1935	2010	75	59	60	60	60	59	30	30	30	30	30
NL	8501900	Goose Bay	53.30	-60.40	1942	2010	68	59	60	60	59	59	29	30	30	29	29
NL	8504175	Wabush Lake	52.90	-66.90	1961	2010	49	44	45	47	46	45	26	26	27	27	26
NL	*840C401*	*St. Anthony*	*51.40*	*-55.60*	*1883*	*2010*	*127*	*43*	*48*	*45*	*46*	*47*	*18*	*18*	*18*	*18*	*19*
NS	8201000	Collegeville	45.50	-62.00	1916	2010	94	42	52	48	54	53	24	26	26	27	27
NS	*8201410*	*Demming*	*45.22*	*-61.18*	*1884*	*2010*	*126*	*52*	*57*	*54*	*54*	*57*	*26*	*28*	*28*	*27*	*28*
NS	8202000	Greenwood	44.98	-64.92	1943	2010	67	59	60	60	60	59	29	30	30	30	29
NS	*8202250*	*Halifax*	*44.70*	*-63.60*	*1872*	*2010*	*138*	*58*	*60*	*60*	*58*	*59*	*28*	*30*	*30*	*28*	*29*
NS	*8205700*	*Sydney*	*46.20*	*-60.10*	*1870*	*2010*	*140*	*57*	*59*	*59*	*59*	*58*	*27*	*29*	*29*	*29*	*28*

Table 2: Site and data collection information for stations used in total precipitation trend analysis for eastern Canada. Stations in italics were used in the 1900-2010 analysis. (continued)

Province	Station Number	Station Name	Latitude	Longitude	First Year of Data	Last Year of Data	Length of Record (Years)	Number of Years Used (1951-2010)					Number of Years Used (1981-2010)				
								Annual	Winter	Spring	Summer	Fall	Annual	Winter	Spring	Summer	Fall
NS	*8206500*	*Yarmouth*	*43.80*	*-66.10*	*1880*	*2010*	*130*	*58*	*60*	*60*	*59*	*59*	*29*	*30*	*30*	*29*	*30*
PE	*8300300*	*Charlottetown*	*46.30*	*-63.10*	*1872*	*2010*	*138*	*56*	*60*	*59*	*58*	*57*	*27*	*30*	*29*	*28*	*28*
QC	*7025250*	*Montréal PET*	*45.50*	*-71.80*	*1872*	*2010*	*138*	*60*	*60*	*60*	*60*	*60*	*30*	*30*	*30*	*30*	*30*
QC	7028441	Thetford Mines	46.10	-71.30	1922	2010	88	48	55	55	53	56	26	27	29	29	29
QC	*7038975*	*Wright*	*46.07*	*-76.05*	*1914*	*2010*	*96*	*52*	*57*	*55*	*57*	*57*	*26*	*27*	*28*	*28*	*28*
QC	7044288	Les Buissons	49.12	-68.38	1947	2010	63	40	48	48	50	53	23	28	25	28	28
QC	*7045400*	*Natashquan*	*50.18*	*-61.82*	*1915*	*2010*	*95*	*44*	*51*	*48*	*51*	*49*	*22*	*23*	*22*	*22*	*22*
QC	7047912	Sept Iles	50.20	-66.30	1945	2010	65	49	56	51	51	49	20	26	21	21	20
QC	*7052605*	*Gaspe*	*48.80*	*-64.50*	*1916*	*2010*	*94*	*43*	*53*	*50*	*53*	*55*	*28*	*30*	*30*	*30*	*28*
QC	*7056480*	*Rimouski*	*48.45*	*-68.52*	*1877*	*2010*	*133*	*46*	*54*	*52*	*54*	*56*	*27*	*29*	*28*	*29*	*28*
QC	*7060400*	*Bagotville*	*48.30*	*-71.00*	*1876*	*2010*	*134*	*59*	*60*	*60*	*60*	*59*	*29*	*30*	*30*	*30*	*29*
QC	7103536	Kuujjuarapik	55.30	-77.80	1934	2010	76	47	50	53	51	50	22	23	25	23	24
QC	7113534	Kuujjuaq	58.10	-68.40	1947	2010	63	52	53	53	53	53	23	23	24	24	23
QC	705C2G9	Iles de la Madeleine	47.40	-61.80	1934	2010	76	47	51	50	52	50	19	22	21	22	21
QC	*709CEE9*	*Lac Berry*	*48.80*	*-78.28*	*1914*	*2010*	*96*	*50*	*57*	*57*	*58*	*54*	*24*	*29*	*29*	*29*	*26*

Table 3: Site and data collection information for stations used in streamflow timing, magnitude, and ice condition trend analysis for rivers in eastern Canada

Province	Station Number	Station Name	Latitude	Longitude	Drainage Basin (km^2)	Regulated?	Hydrologic Years	Hydrologic Years Used	Years of Data
NB	01AF002	Saint John River (GrandFalls)	47.04	-67.74	21900	Yes	1949-2010	1950-2009	60
NB	01AP004	Kennebicasis (Apohaqui)	45.70	-65.60	1100	No	1960-2010	1961-2009	49
NB	01BC001	Restigouche (Kedgwick River)	47.67	-67.48	3160	No	1962-2010	1962-2009	48
NB	01BP001	LSW Miramichi (Lyttleton)	46.94	-65.91	1340	No	1950-2010	1951-2009	59
NB	01BS001	Coal Branch of Richibucto River	46.44	-65.07	166	No	1963-2010	1964-2009	46
NB	01BV006	Pointe Wolfe	45.56	-65.02	130	No	1963-2010	1964-2009	46
NL	02YC001	Torrent River	50.61	-57.15	624	No	1958-2010	1959-2009	51
NL	02YJ001	Harry's River	48.58	-58.36	640	No	1967-2010	1968-2009	42
NL	02YL001	Upper Humber River (Reidville)	49.24	-57.36	2110	No	1951-2010	1952-2009	58
NL	02YO001	Exploits River	48.93	-55.67	8390	Yes	1949-2010	1950-2009	59
NL	02YQ001	Gander River (Big Chute)	49.02	-54.85	4450	No	1949-2010	1950-2009	60
NL	02ZF001	Bay du Nord River (Big Falls)	47.75	-58.44	1170	No	1950-2010	1951-2009	58
NL	02ZH001	PipersHole River (Mothers Brook)	47.95	-54.28	764	No	1952-2010	1952-2009	58
NL	02ZK001	Rocky River (Colinet)	47.23	-53.57	301	No	1949-2010	1950-2009	60
NL	03NF001	Ugjoktok River (Harp Lake)	55.23	-61.30	7570	No	1978-2010	1979-2009	30
NL	03OE001	Churchill River (Muskrat Falls)	53.25	-60.79	92500	Yes	1953-2010	1953-2009	55
NL	03QC002	Alexis River (Port Hope Simpson)	52.65	-56.87	2310	No	1977-2010	1978-2009	32
NS	01DC005	Annapolis River (Wilmot)	44.95	-65.03	546	Yes	1963-2010	1964-2009	47
NS	01DR001	South River	45.60	-61.90	117	No	1964-2010	1965-2009	45
NS	01EC001	Roseway River	43.84	-65.37	495	No	1949-2010	1950-2009	60
NS	01EF001	LeHave River	44.45	-64.59	1250	No	1949-2010	1950-2009	60

Table 3: Site and data collection information for stations used in streamflow timing, magnitude, and ice condition trend analysis for rivers in eastern Canada (continued)

Province	Station Number	Station Name	Latitude	Longitude	Drainage Basin (km^2)	Regulated?	Hydrologic Years	Hydrologic Years Used	Years of Data
NS	01EO001	St. Mary's River	45.17	-61.98	1350	No	1949-2010	1950-2009	60
NS	01FB001	NE Margaree River	46.37	-60.98	368	No	1949-2010	1950-2009	60
PE	01CA003	Carruthers Brook	46.74	-64.19	46.8	No	1960-2010	1961-2009	49
PE	01CB004	Wilmot River	46.39	-63.66	45.4	Yes	1971-2010	1972-2009	38
QC	21601	Matane	48.77	-67.51	1650	Yes	1949-2011	1950-2009	60
QC	23402	Chaudière	46.59	-71.21	5820	Yes	1949-2011	1950-2009	60
QC	30103	Nicolet	46.06	-72.31	1540	No	1966-2011	1967-2009	43
QC	30234	Eaton	45.47	-71.66	642	No	1953-2011	1954-2009	53
QC	40212	Saint-Louis	46.37	-74.51	39.9	No	1968-2011	1969-2009	34
QC	43012	Kinojévis	48.37	-78.85	2590	No	1967-2011	1968-2009	39
QC	43301	Des Prairies	45.51	-73.85	146000	Yes	1949-2011	1950-2009	53
QC	50119	Mattawin	46.68	-76.91	1390	No	1949-2011	1950-2009	59
QC	61004	Chicoutimi	48.31	-71.21	3390	Yes	1949-2011	1950-2009	59
QC	72301	Moisie	50.35	-66.19	19000	No	1965-2011	1966-2009	41
QC	73801	Romaine	50.31	-63.62	13000	No	1956-2011	1957-2009	51
QC	80101	Harricana	48.60	-78.11	3680	No	1949-2011	1950-2009	58
QC	80707	Bell	49.76	-77.62	22200	No	1962-2011	1963-2009	42
QC	93801	Grande rivière de la Baleine	55.24	-76.99	33998	No	1961-2011	1962-2009	39
QC	95003	Lac des Loups Marins	56.45	-74.22	9743	No	1974-2011	1975-2009	29
QC	103605	Aux Mélèzes	57.68	-69.62	39869	No	1962-2011	1963-2009	27
QC	104001	À la Baleine	57.89	-67.60	29472	No	1962-2011	1963-2009	37

Table 4: Start and end days for winter, spring, and summer seasons for streamflow analysis stations. Negative days refer to days prior to January 1.

Province	Station Number	Winter Start	Winter End	Spring Start	Spring End	Summer Start	Summer End
NB	01AF002	-30	130	50	180	150	273
NB	01AP004	-30	120	50	180	150	273
NB	01BC001	-30	130	50	180	150	273
NB	01BP001	-30	130	50	180	150	273
NB	01BS001	-30	100	50	150	130	273
NB	01BV006	-30	100	50	150	130	273
NL	02YC001	-30	130	50	200	180	273
NL	02YJ001	-30	130	50	200	180	273
NL	02YO001	-30	130	50	200	180	273
NL	02YQ001	-30	130	50	200	180	273
NL	02ZF001	-30	130	50	180	150	273
NL	02ZH001	-30	120	50	180	150	273
NL	02ZK001	-30	80	50	150	150	273
NL	03NF001	-30	150	50	200	180	273
NL	03OE001	-30	150	50	225	180	273
NL	03QC002	-30	130	50	200	150	273
NS	01DC005	-30	120	50	150	130	273
NS	01DR001	-30	120	50	150	130	273
NS	01EC001	-30	100	50	150	130	273
NS	01EF001	-30	100	50	150	150	273
NS	01EO001	-30	100	50	150	150	273
NS	01FB001	-30	130	50	180	150	273
PE	01CA003	-30	100	50	150	130	273
PE	01CB004	-30	100	50	150	130	273
QC	21601	-30	130	50	180	150	273
QC	23402	-30	130	50	180	150	273
QC	30103	-30	130	50	180	150	273
QC	30234	-30	130	50	180	150	273
QC	40212	-30	130	50	180	150	273
QC	43012	-30	130	50	180	150	273
QC	43301	-20	130	50	180	150	273
QC	50119	-20	130	50	180	150	273
QC	61004	-30	130	50	180	150	273
QC	72301	-30	130	50	180	150	273
QC	73801	-30	130	50	200	180	273
QC	80101	-30	130	50	200	180	273
QC	80707	-30	130	50	200	180	273
QC	93801	-30	150	50	200	180	273
QC	95003	-30	180	50	250	200	273
QC	103605	-30	150	50	200	180	273
QC	104001	-30	150	50	200	180	273

Table 5: Results from the repeated measures ANOVA to test for inter-seasonal differences (seen here as 'season 1 vs. season 2') in mean rates of change for eastern Canada. For air temperature, rates of change are °C per decade. For total precipitation, rates of change are % per decade. p-value in italic are significant (<0.05).

Repeated Measures ANOVA Results					Post-hoc Tukey's tests					
Comparison	Time Period	n	F-ratio	p-value	Season 1	mean	Season 2	mean	|T-stat|	Adjusted p-value
Air Temperature	1951 - 2010	148	13.47	*<0.001*	Autumn	0.1262	Spring	0.0686	2.186	0.134
					Autumn	0.1262	Summer	0.1992	2.769	*0.033*
					Autumn	0.1262	Winter	0.0460	3.046	*0.015*
					Spring	0.0686	Summer	0.1992	4.955	*<0.001*
					Spring	0.0686	Winter	0.0460	0.860	0.825
					Summer	0.1992	Winter	0.0460	5.815	*<0.001*
Air Temperature	1981 - 2010	148	22.84	*<0.001*	Autumn	0.4937	Spring	0.0534	7.533	*<0.001*
					Autumn	0.4937	Summer	0.3497	2.464	0.072
					Autumn	0.4937	Winter	0.4459	0.817	0.846
					Spring	0.0534	Summer	0.3497	5.069	*<0.001*
					Spring	0.0534	Winter	0.4459	6.716	*<0.001*
					Summer	0.3497	Winter	0.4459	1.647	0.357
Air Temperature	1900 - 2010	92	4.25	*0.008*	Autumn	0.0979	Spring	0.1377	2.522	0.066
					Autumn	0.0979	Summer	0.1226	1.562	0.408
					Autumn	0.0979	Winter	0.1517	3.405	*0.006*
					Spring	0.1377	Summer	0.1226	0.960	0.773
					Spring	0.1377	Winter	0.1517	0.880	0.814
					Summer	0.1226	Winter	0.1517	1.873	0.263
Total Precipitation	1951 - 2010	140	5.68	*0.001*	Autumn	2.5368	Spring	1.6790	1.446	0.474
					Autumn	2.5368	Summer	0.5542	3.341	*0.006*
					Autumn	2.5368	Winter	0.4235	3.562	*0.003*

Table 5: Results from the repeated measures ANOVA to test for inter-seasonal differences (seen here as 'season 1 vs. season 2') in mean rates of change for eastern Canada. For air temperautre, rates of change are °C per decade. For total precipitation, rates of change are % per decade. p-value in italic are signficant (<0.05). (continued)

Repeated Measures ANOVA Results					Post-hoc Tukey's tests					
Comparison	Time Period	n	F-ratio	p-value	Season 1	mean	Season 2	mean	|T-stat|	Adjusted p-value
Total Precipitation (continued)	1951 - 2010	140	5.68	*0.001*	Spring	1.6790	Summer	0.5542	1.896	0.236
					Spring	1.6790	Winter	0.4235	2.116	0.155
					Summer	0.5542	Winter	0.4235	0.220	0.996
Total Precipitation	1981 - 2010	140	3.84	*0.012*	Autumn	1.5300	Spring	-0.7830	2.462	0.072
					Autumn	1.5300	Summer	-0.8370	2.520	0.063
					Autumn	1.5300	Winter	-1.4110	3.130	*0.012*
					Spring	-0.7830	Summer	-0.8370	0.058	0.999
					Spring	-0.7830	Winter	-1.4110	0.668	0.909
					Summer	-0.8370	Winter	-1.4110	0.610	0.929
Total Precipitation	1900 - 2010	76	1.86	0.148	not applicable					

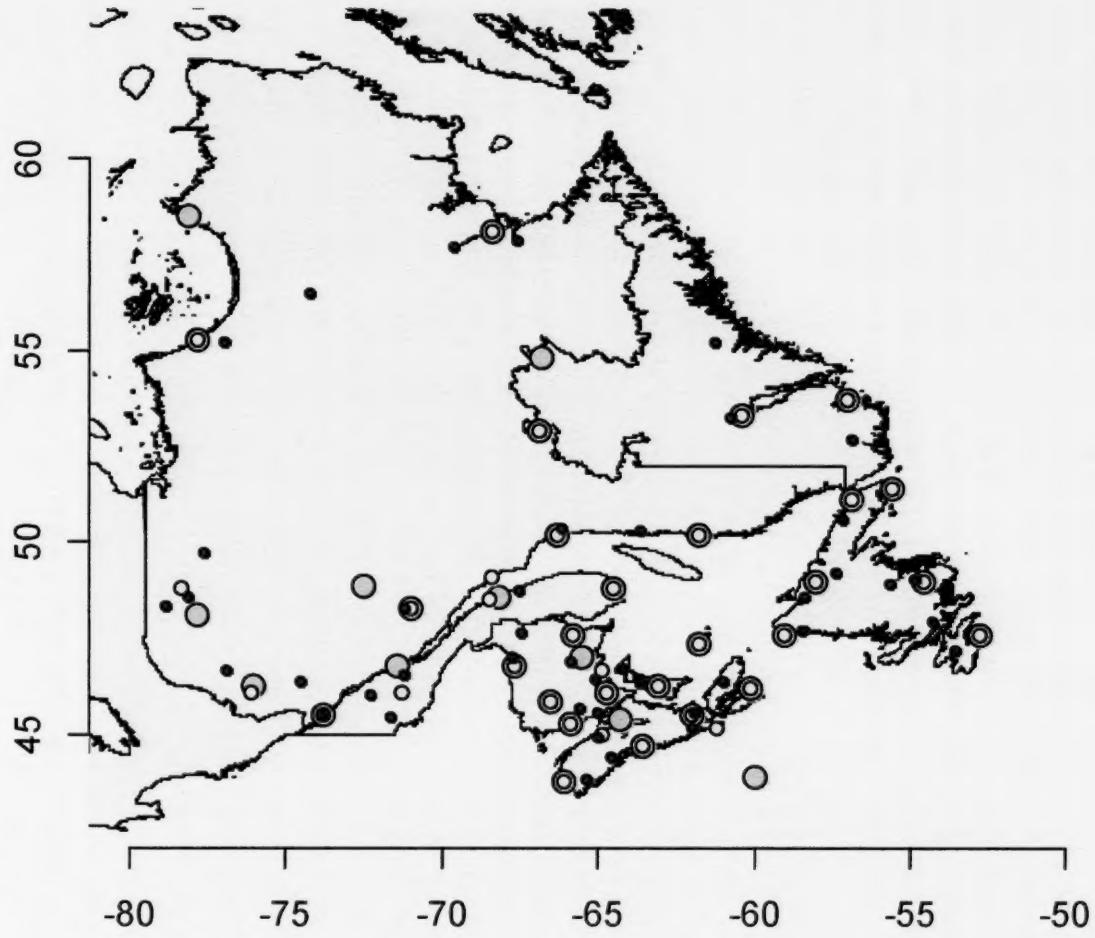

Figure 1: Map of selected stations for air temperature, total precipitation, and streamflow trend analysis. Orange circles denote air temperature stations, pale blue circles denote precipitation stations, dark blue circles denote streamflow stations.

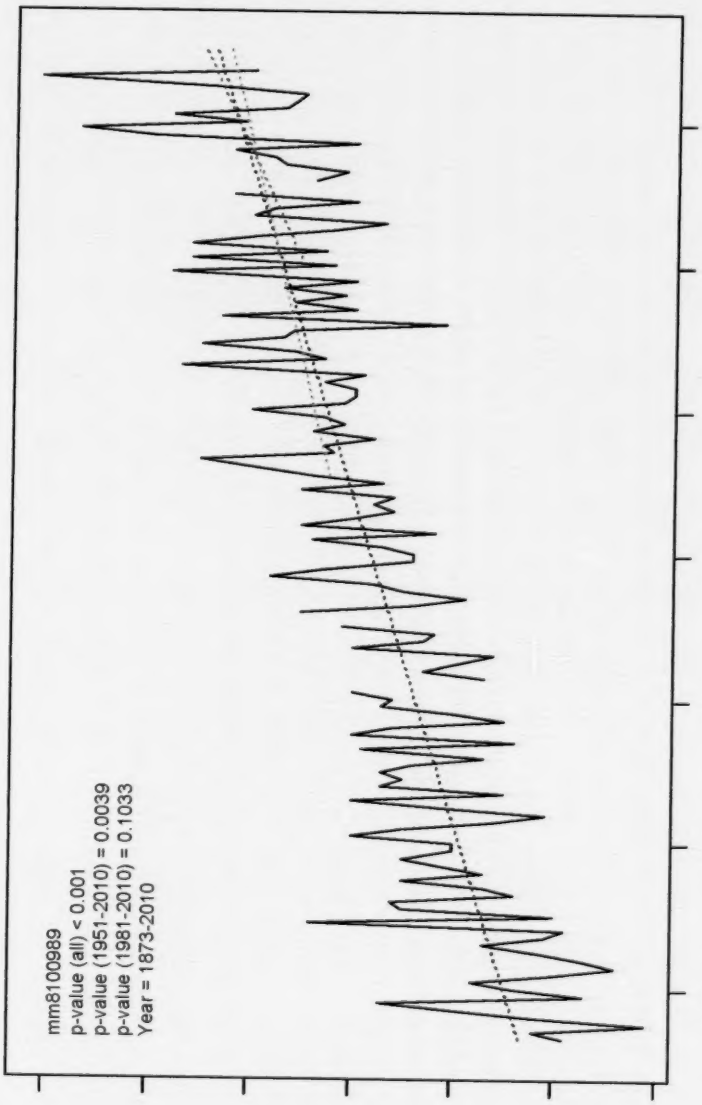

Figure 2: An example of how trends in mean annual air temperature were determined using data from Chatham-Miramichi, NB. Linear trends were calculated for the past 30 years, 60 years, and entire record length.

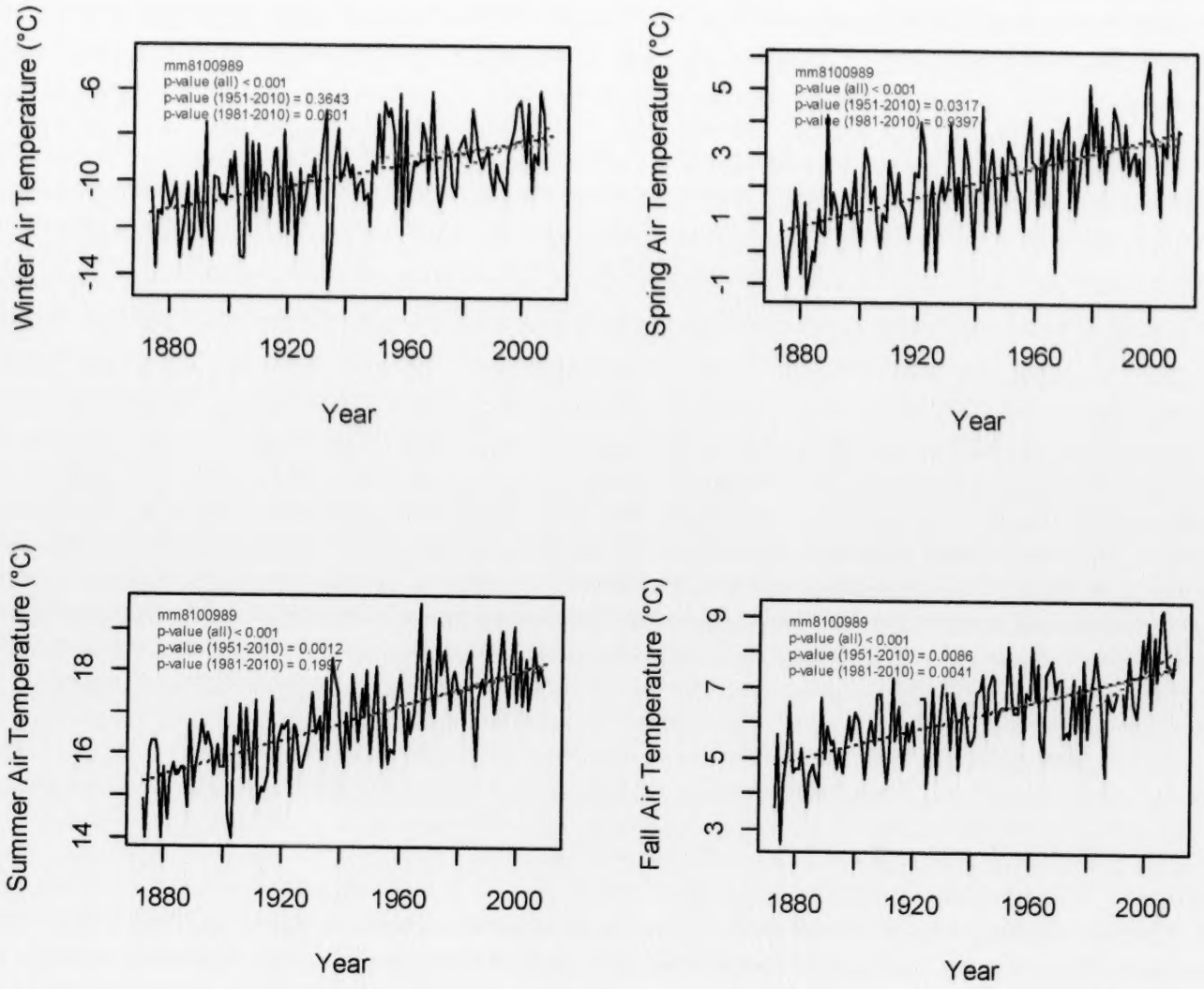

Figure 3: An example of how trends in mean seasonal air temperatures were determined using data from Chatham-Miramichi, NB. Linear trends were calculated for the past 30 years, 60 years, and entire record length. Seasonal were defined as: winter = December, January, February; spring = March, April, May; Summer = June, July, August; Fall = September, October, November.

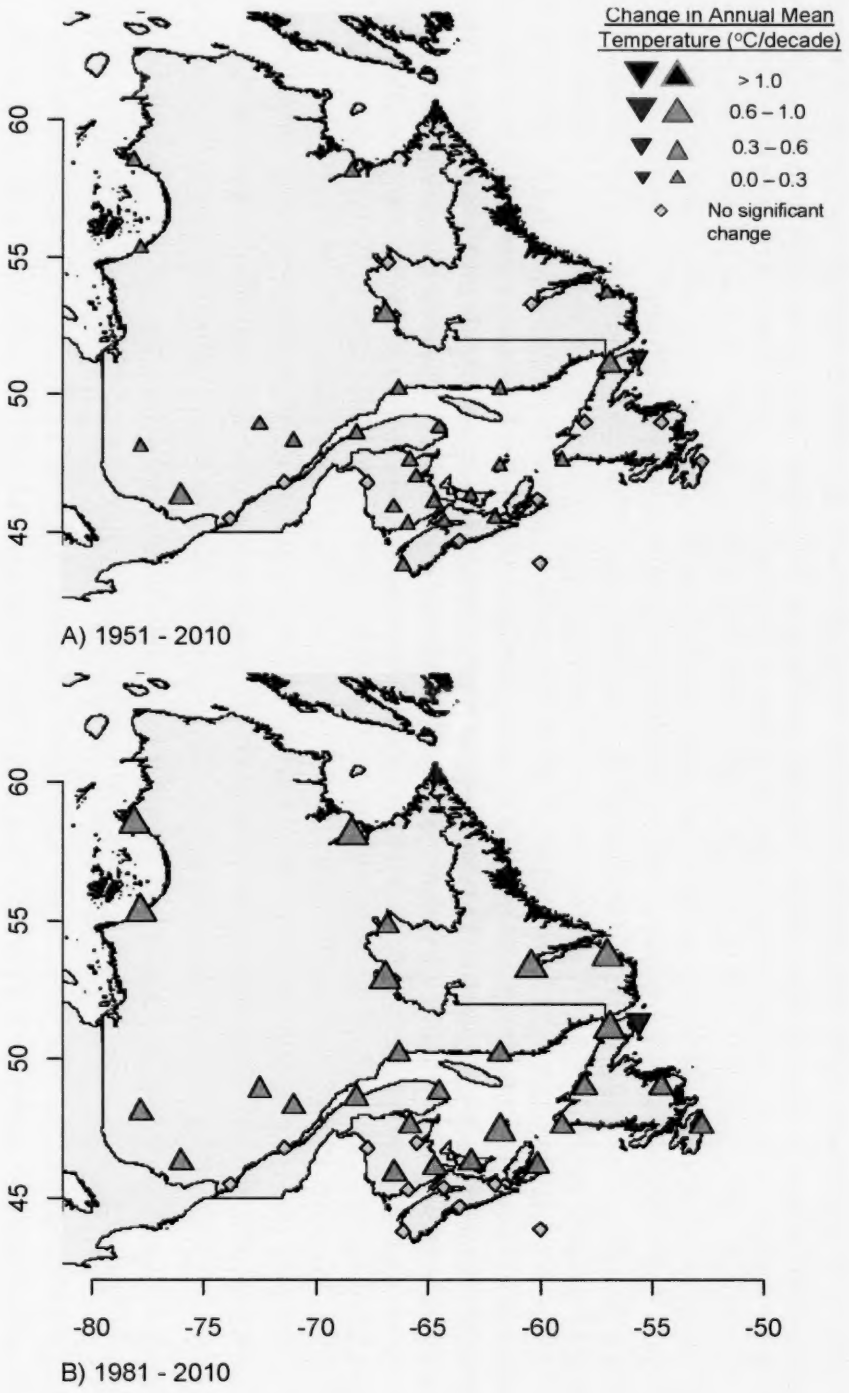

Figure 4: Changes in mean annual air temperature, expressed as °C/decade, over the past 60 years (A) and the past 30 years (B) in eastern Canada

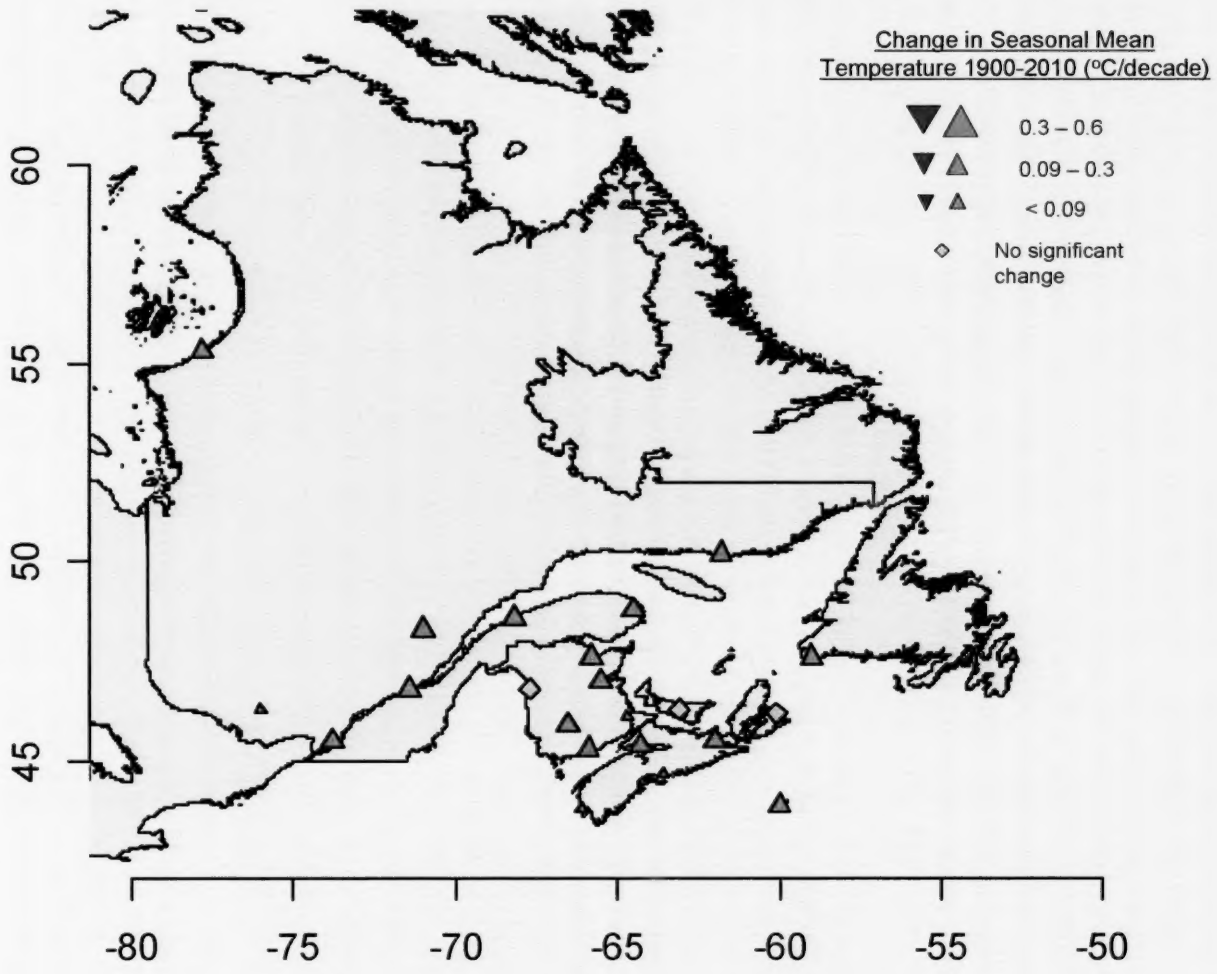

Figure 5: Changes in mean annual air temperatures, expressed as °C/decade, from 1900-2010 in eastern Canada

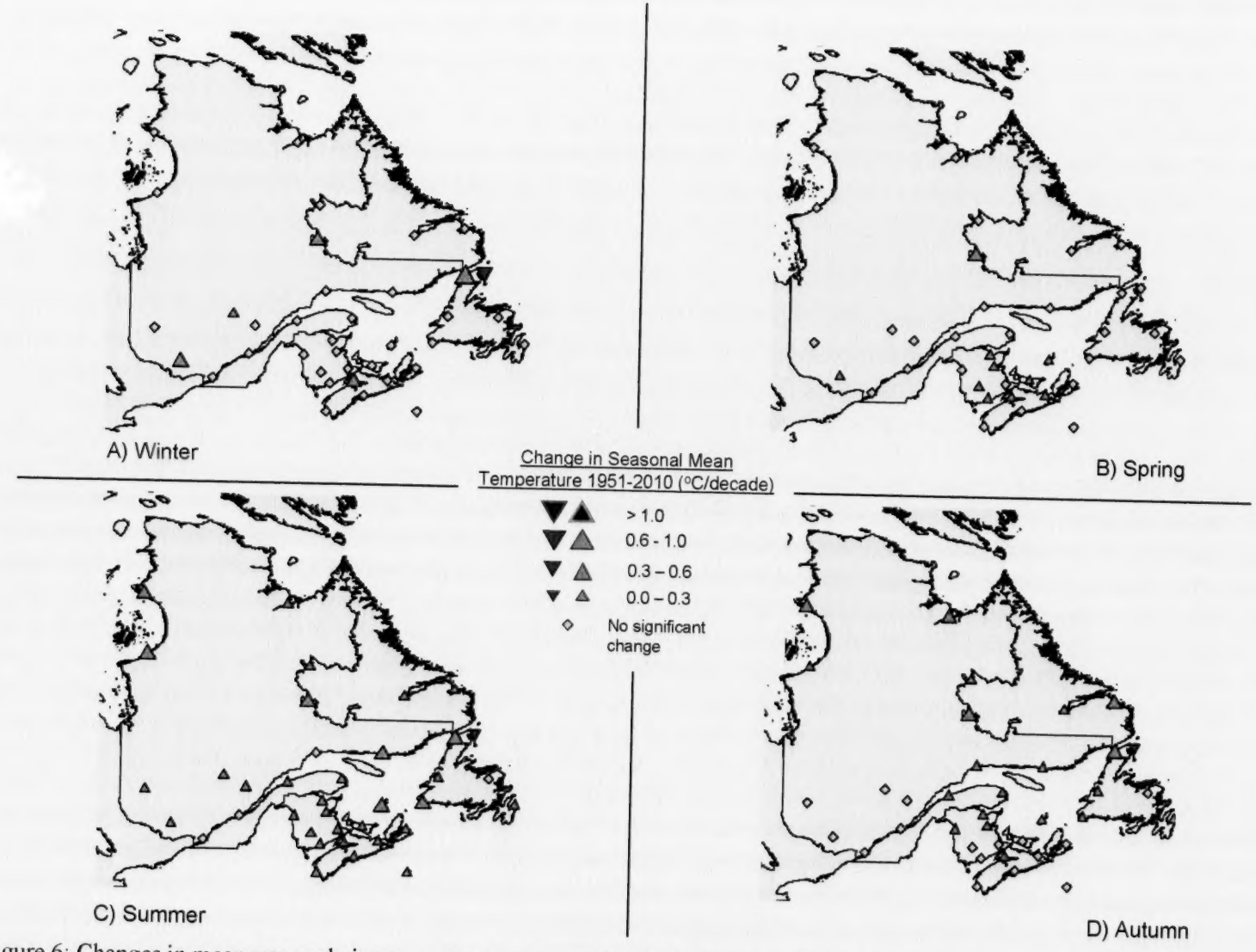

Figure 6: Changes in mean seasonal air temperatures, expressed as °C/decade, over the past 60 years in eastern Canada for A) winter (December, January, February) B) spring (March, April, May) C) summer (June, July, August) D) Autumn (September, October, November).

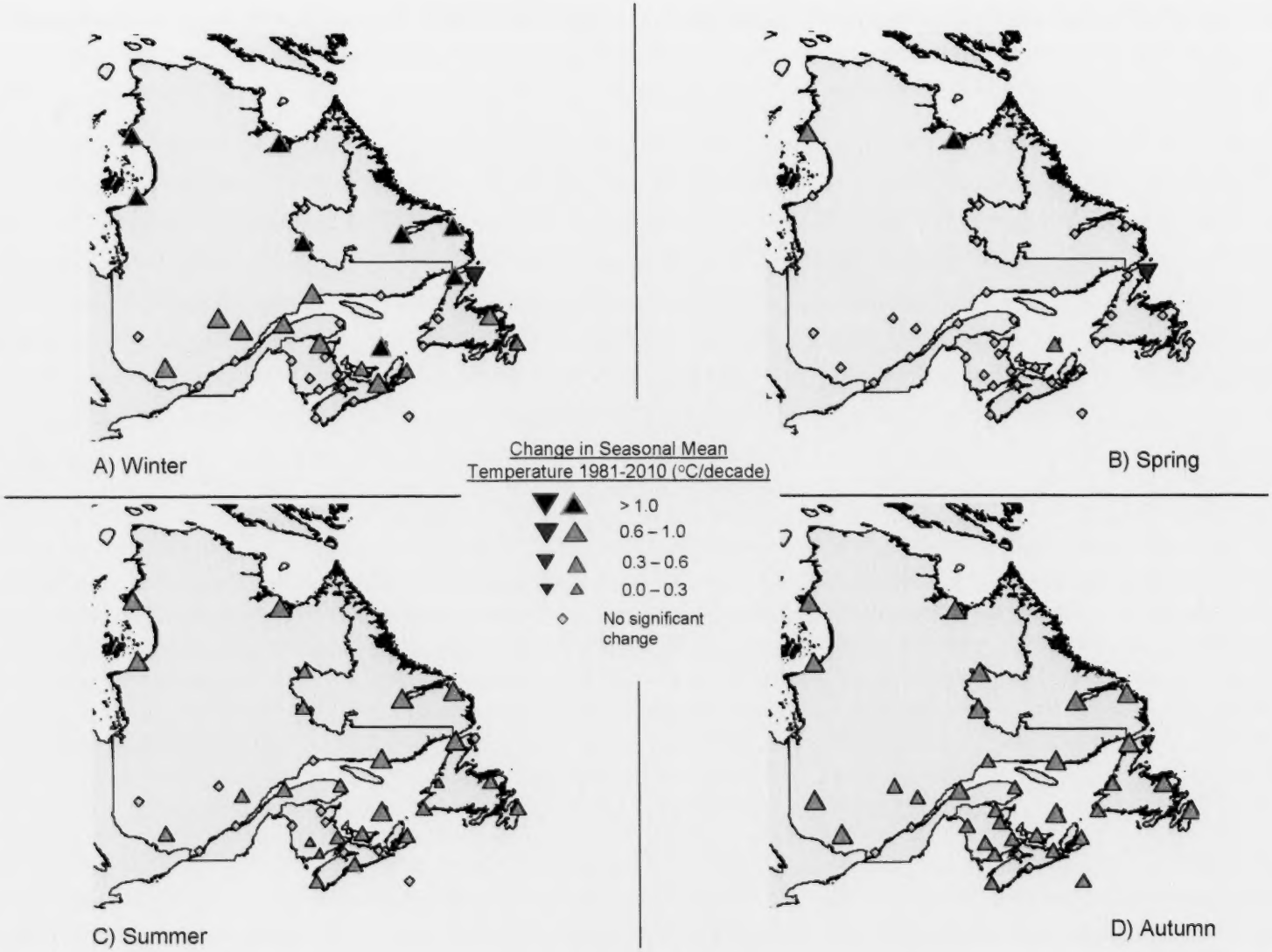

Figure 7: Changes in mean seasonal air temperatures, expressed as °C/decade, over the past 30 years in eastern Canada for A) winter (December, January, February) B) spring (March, April, May) C) summer (June, July, August) D) Autumn (September, October, November).

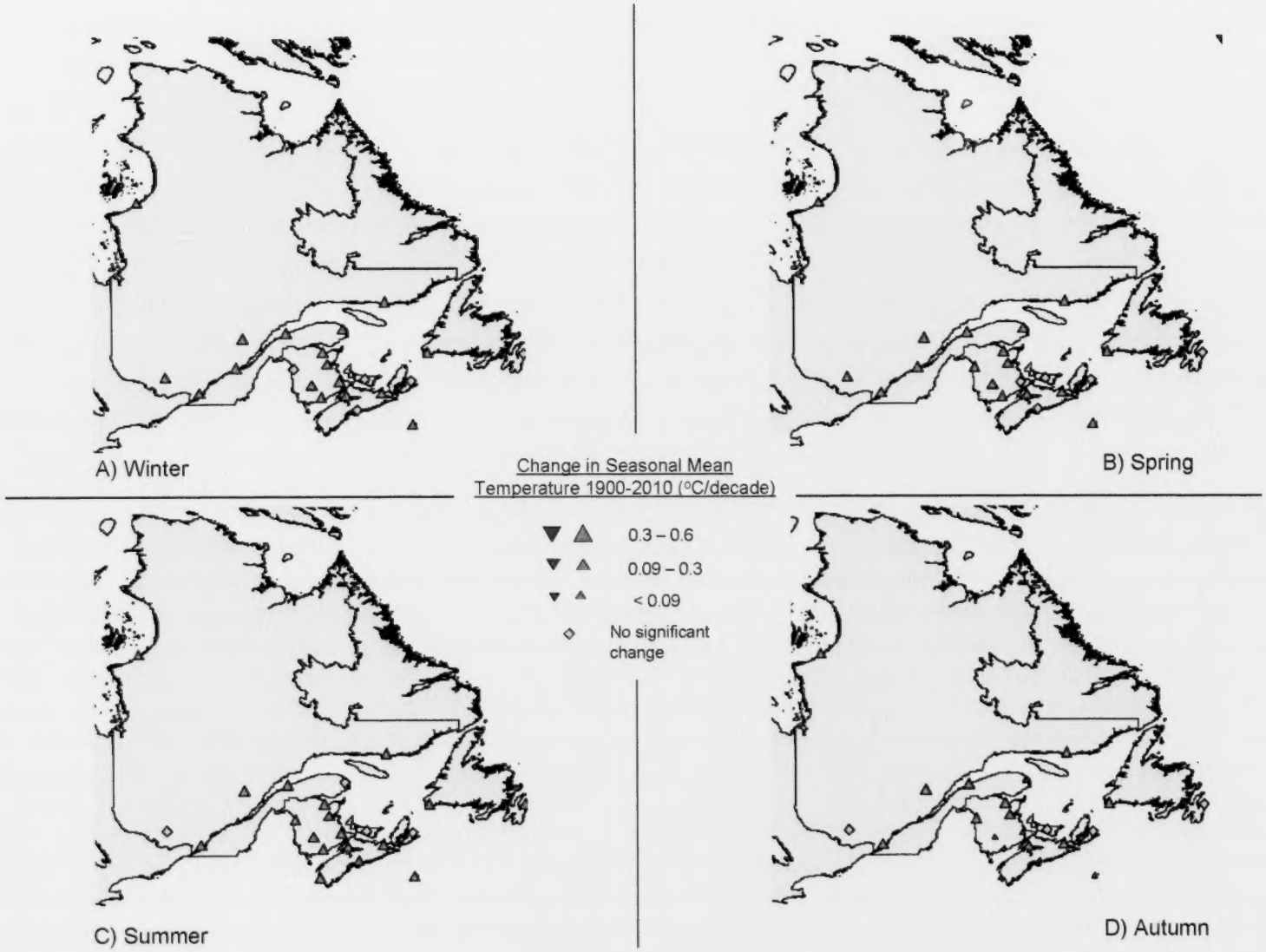

Figure 8: Changes in mean seasonal air temperatures, expressed as °C/decade, from 1900-2010 in eastern Canada for A) winter (December, January, February) B) spring (March, April, May) C) summer (June, July, August) D) Autumn (September, October, November).

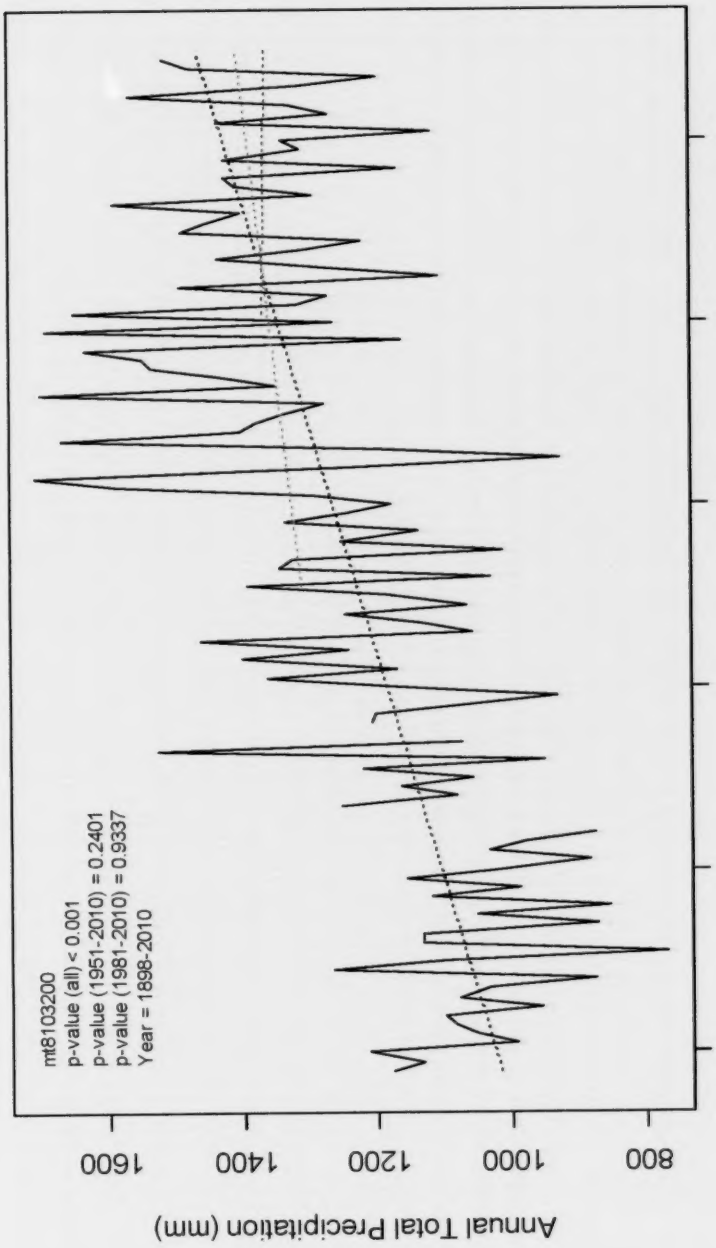

Figure 9: An example of how trends in total annual precipitation were determined using data from Moncton, NB. Linear trends were calculated for the past 30 years, 60 years, and entire record length.

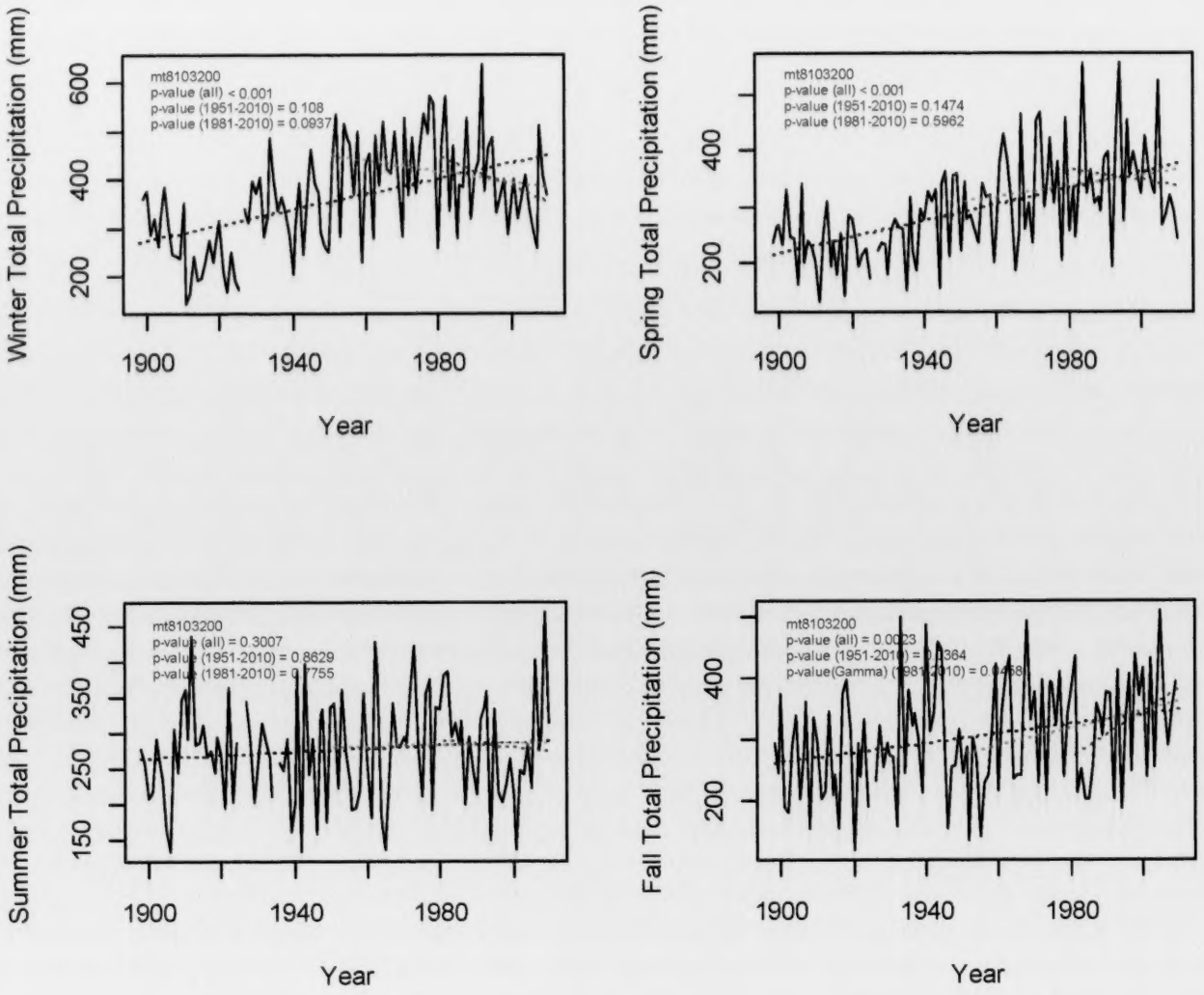

Figure 10: An example of how trends in total seasonal precipitation were determined using data from Moncton, NB. Linear trends were calculated for the past 30 years, 60 years, and entire record length. Seasonal were defined as: winter = December, January, February; spring = March, April, May; Summer = June, July, August; Fall = September, October, November.

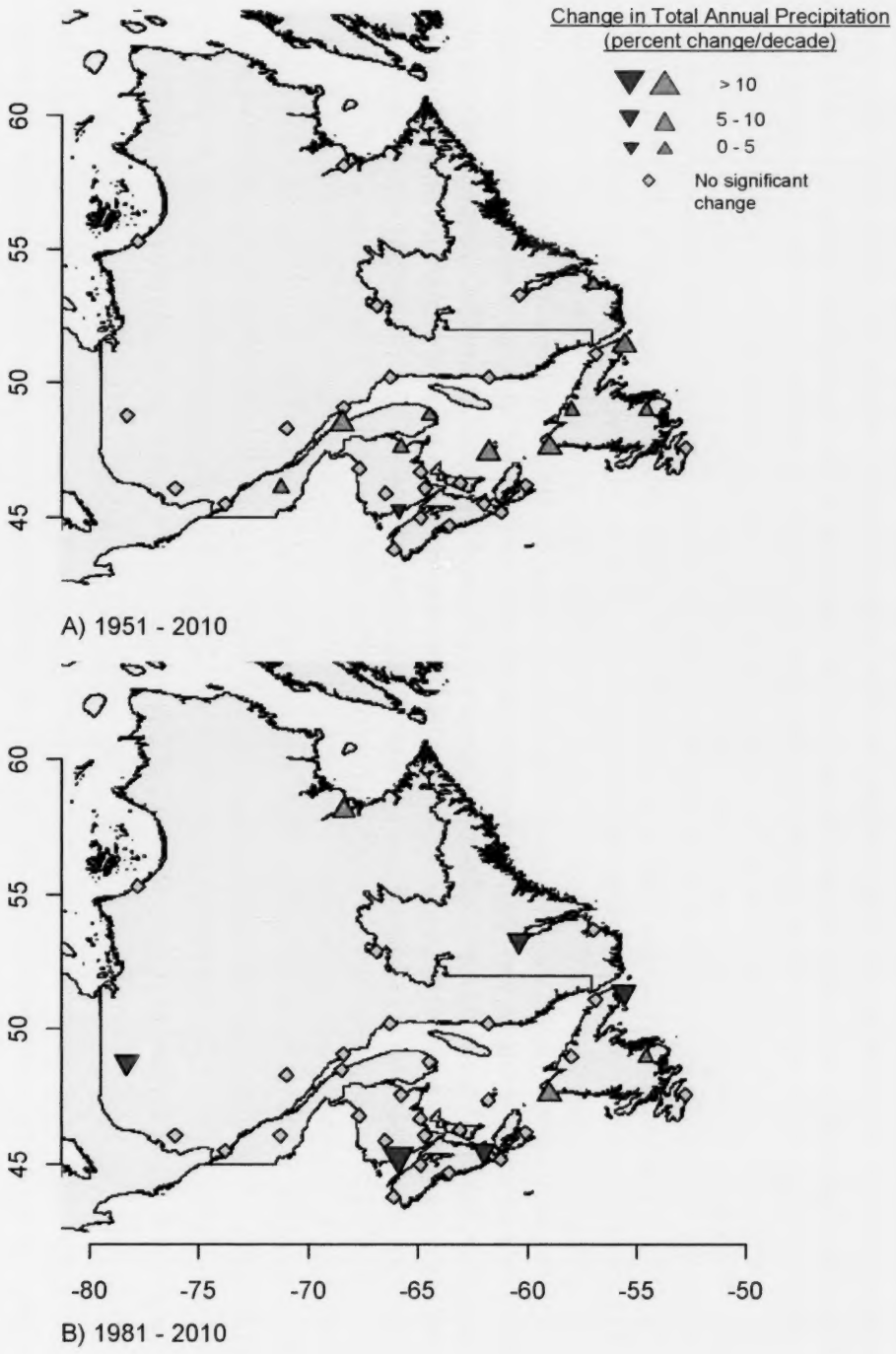

Figure 11: Changes in total annual precipitation, expressed as percent change per decade, over the past 60 years (A) and the past 30 years (B) in eastern Canada

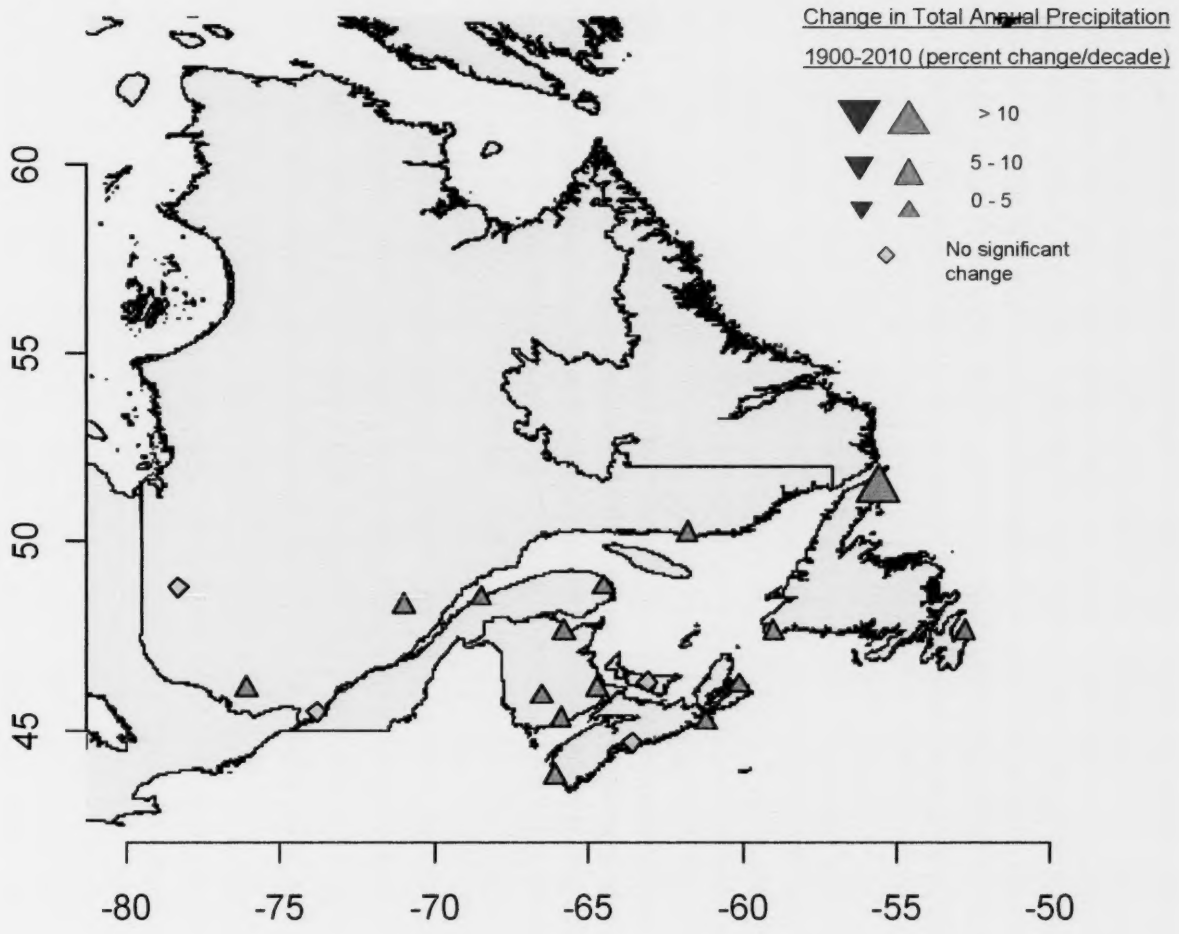

Figure 12: Changes in total annual precipitation, expressed as percent change per decade, from 1900-2010 in eastern Canada

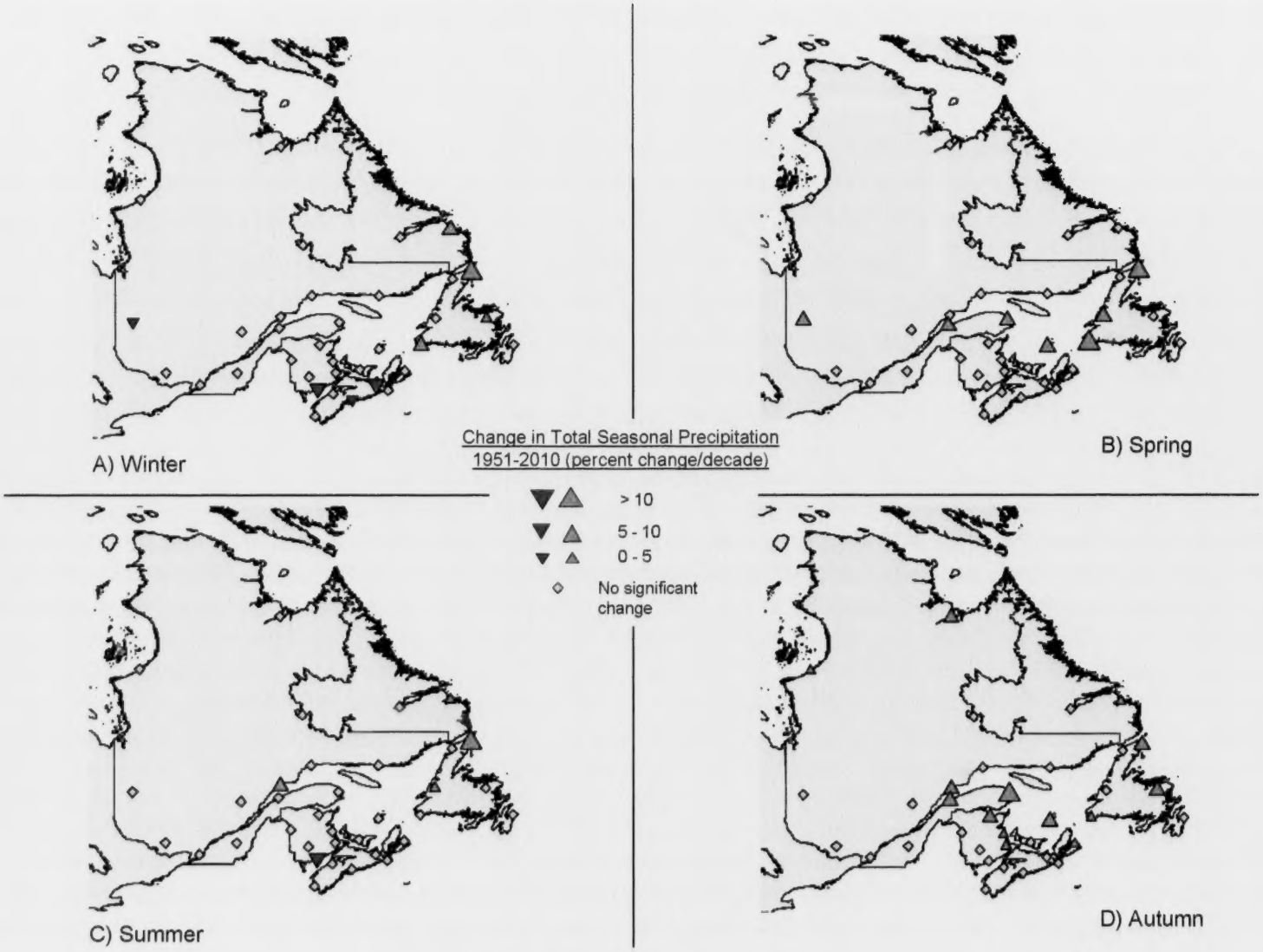

Figure 13: Changes in total seasonal precipitation, expressed as percent change per decade, over the past 60 years in eastern Canada for A) winter (December, January, February) B) spring (March, April, May) C) summer (June, July, August) D) Autumn (September, October, November).

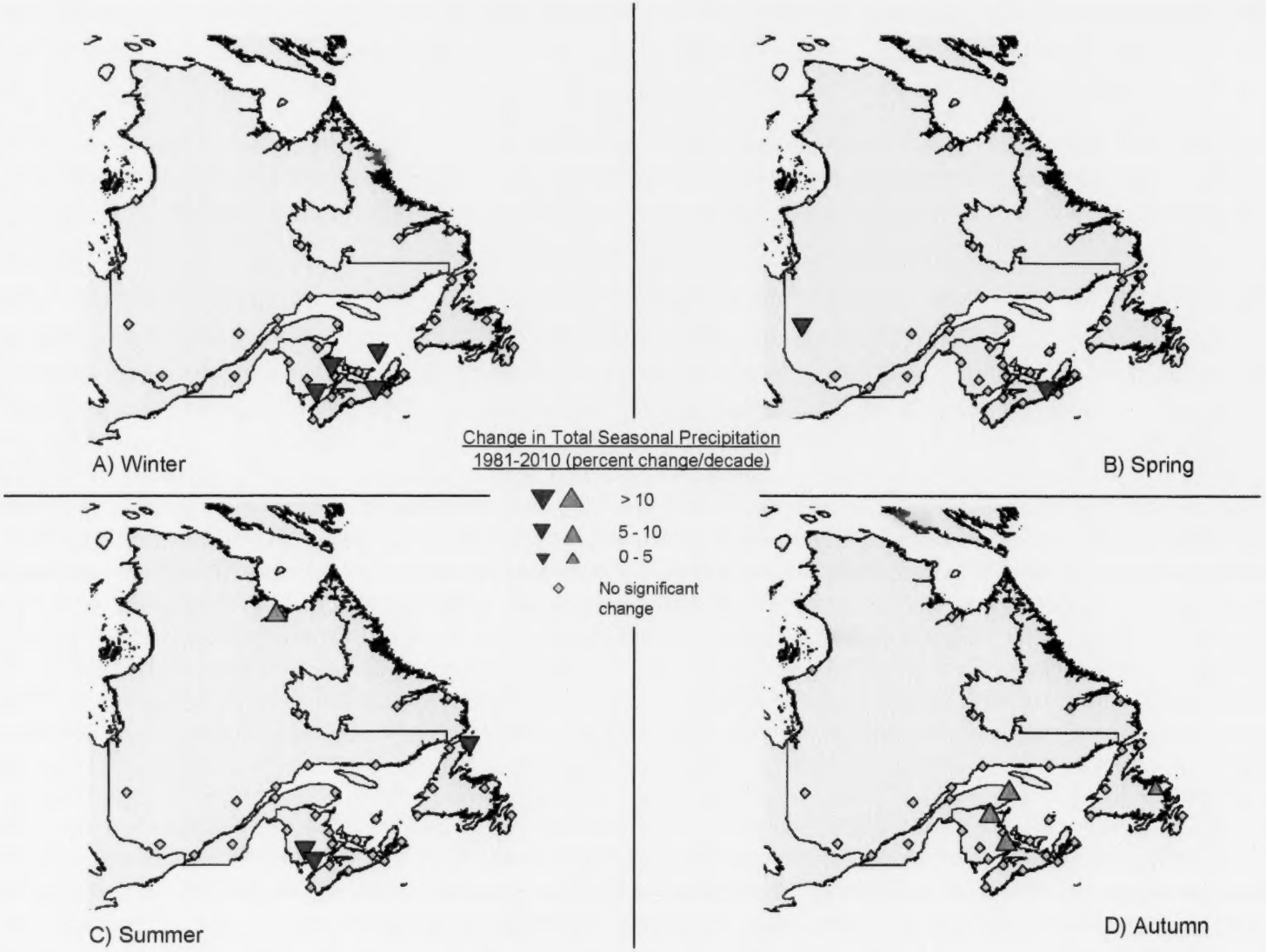

Figure 14: Changes in total seasonal precipitation, expressed as percent change per decade, over the past 30 years in eastern Canada for A) winter (December, January, February) B) spring (March, April, May) C) summer (June, July, August) D) Autumn (September, October, November).

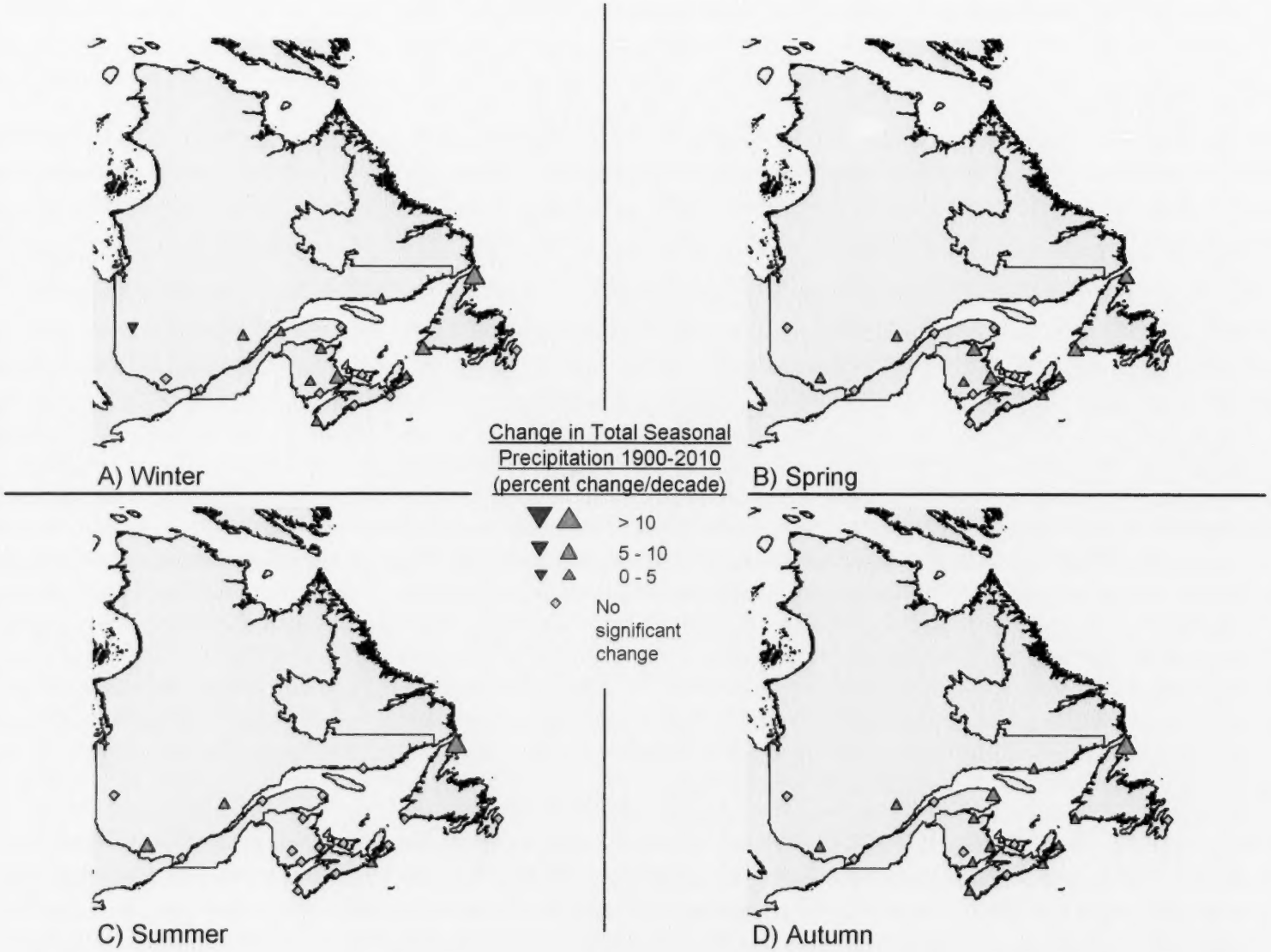

Figure 15: Changes in total seasonal precipitation, expressed as percent change per decade, from 1900-2010 in eastern Canada for A) winter (December, January, February) B) spring (March, April, May) C) summer (June, July, August) D) Autumn (September, October, November).

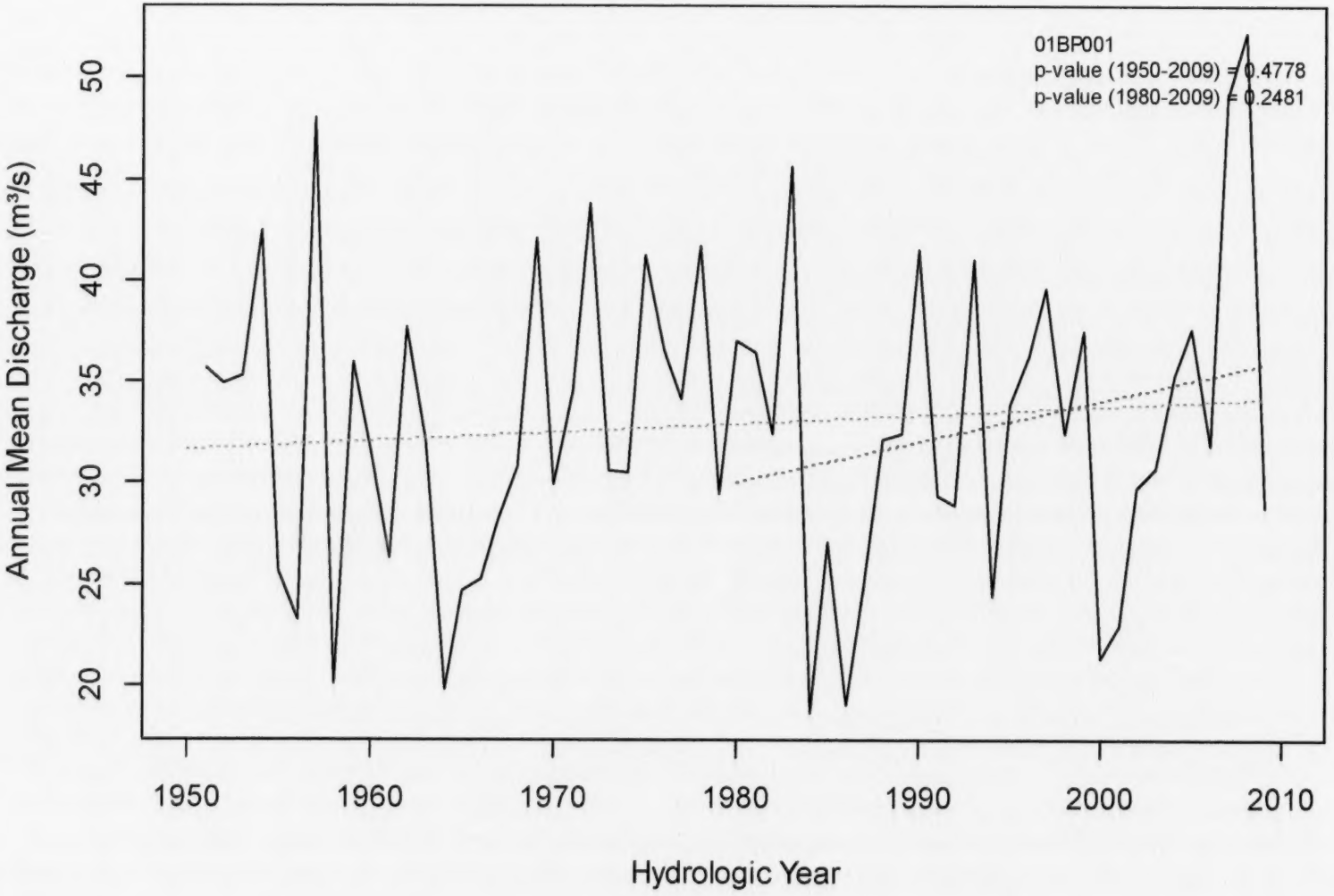

Figure 16: An example of how trends in annual mean discharge were determined using data from the Little Southwest Miramichi River (at Lyttleton), NB. Linear trends were calculated for the past 30 and 60 hydrologic years

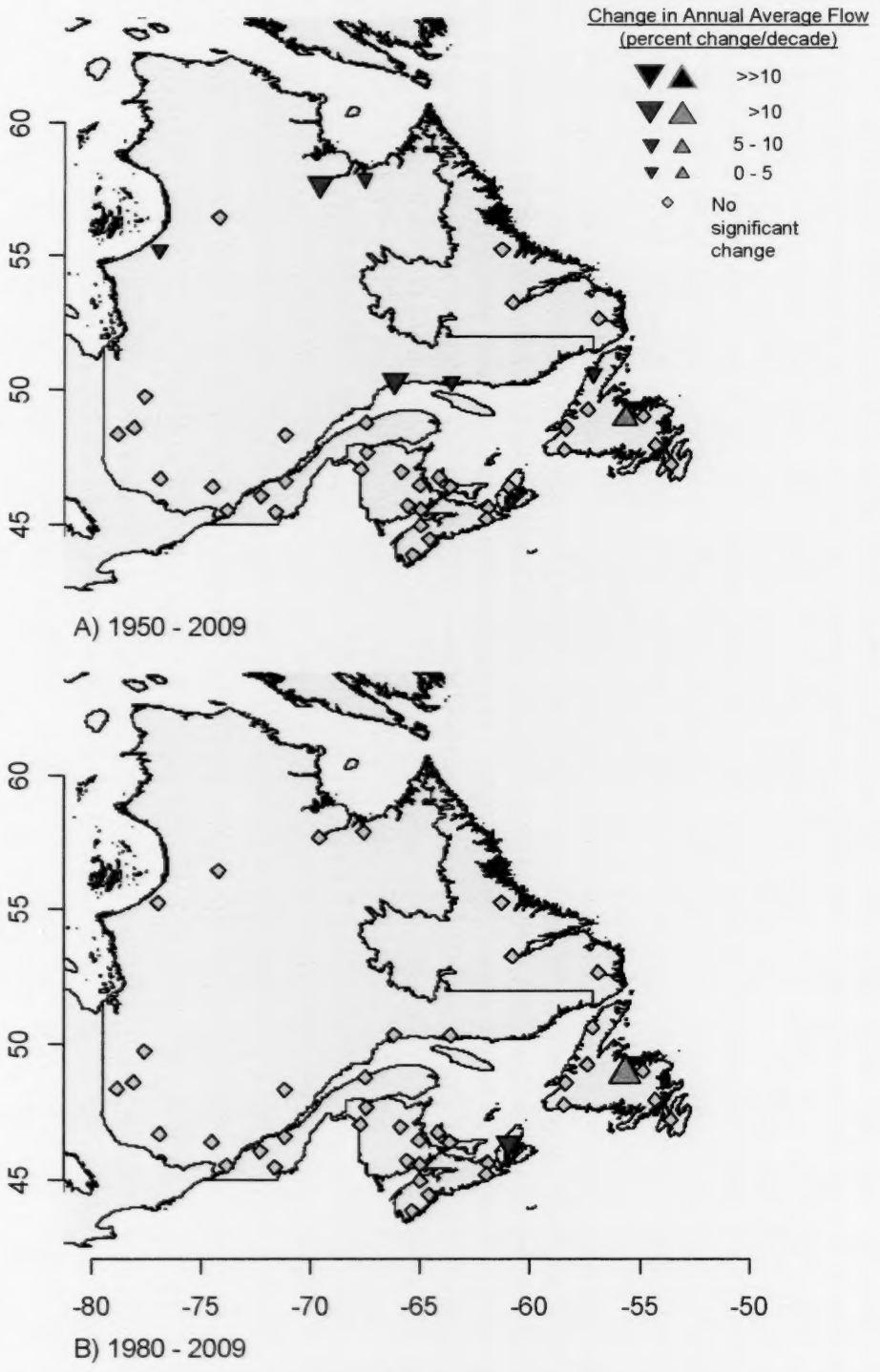

Figure 17: Changes in mean annual flow of rivers in eastern Canada, expressed as percent change per decade, over the past 60 years (A) and past 30 years (B)

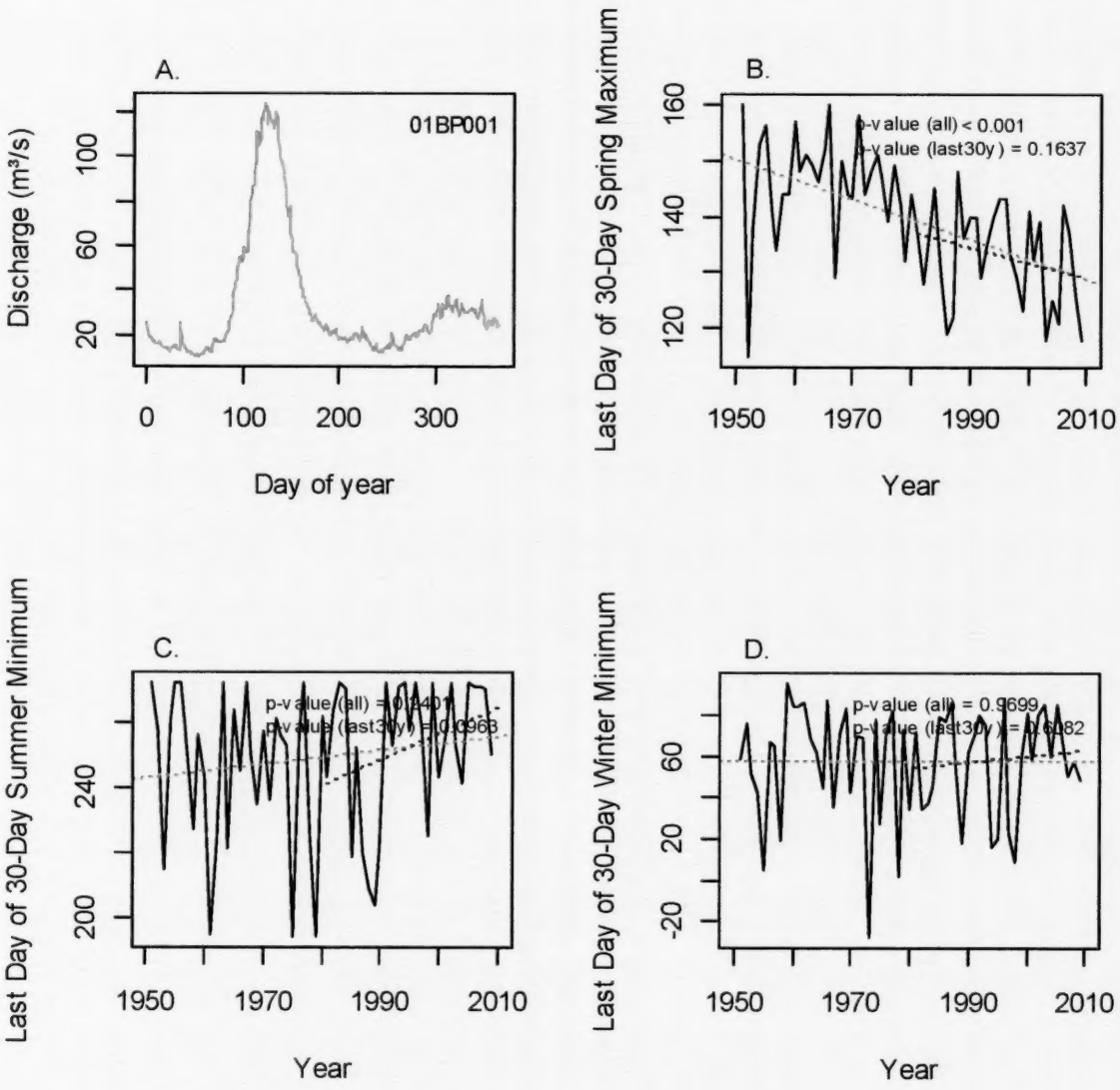

Figure 18: An example of how trends in temporal changes in streamflow dynamics were determined using data from the Little Southwest Miramichi River (at Lyttleton), NB, over the past 30 and 60 hydrologic years. A) Mean daily hydrograph 1950-2009. B) Last day of the highest Spring discharge period over time. C) Last day of the lowest Summer discharge period over time. D) Last day of the lowest Winter discharge period over time. Days are day of year. 'Negative days' are days before January 1and extend to December 1 (-30).

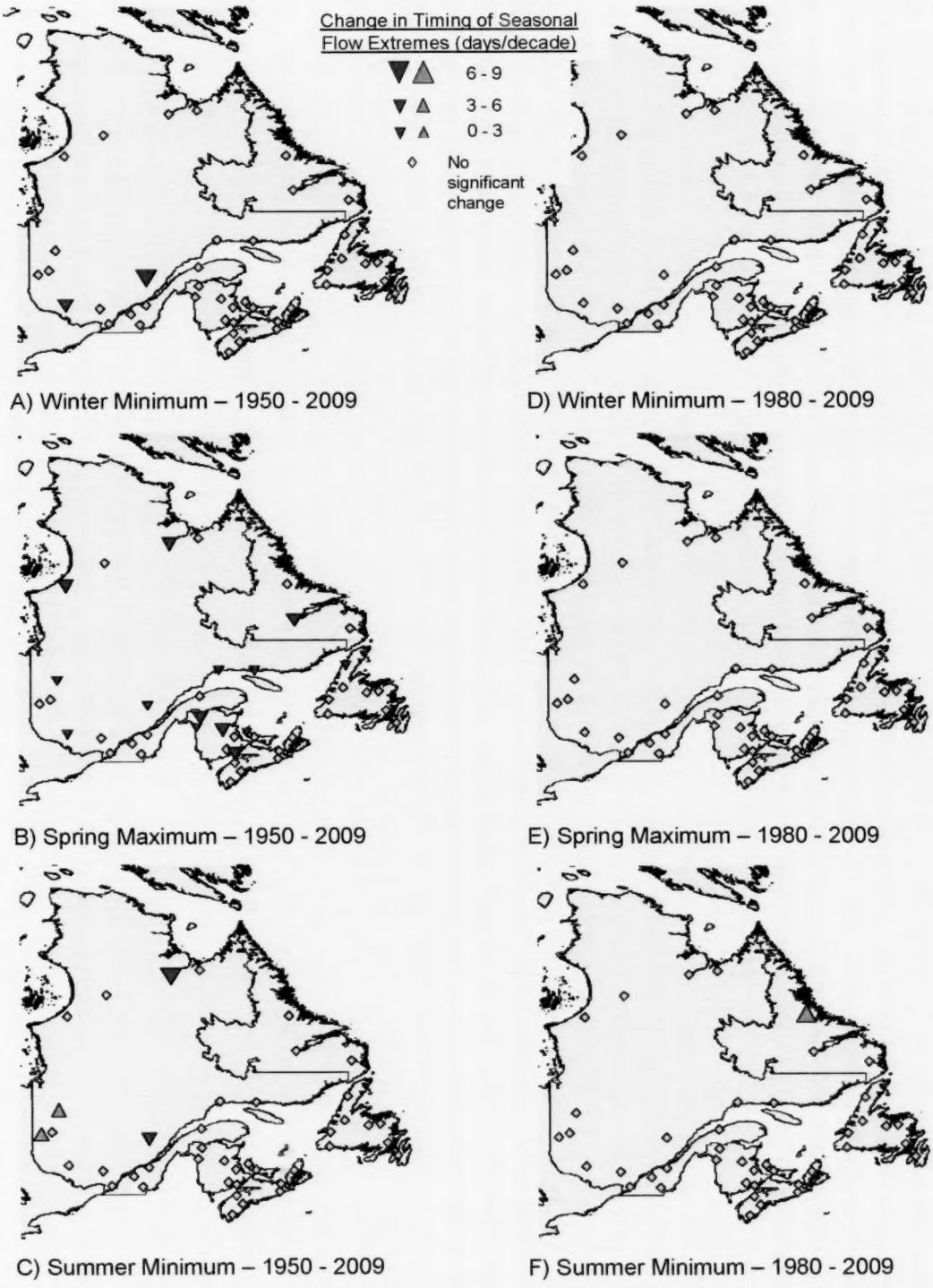
Change in Timing of Seasonal Flow Extremes (days/decade)
6 - 9
3 - 6
0 - 3
No significant change
A) Winter Minimum – 1950 - 2009
D) Winter Minimum – 1980 - 2009
B) Spring Maximum – 1950 - 2009
E) Spring Maximum – 1980 - 2009
C) Summer Minimum – 1950 - 2009
F) Summer Minimum – 1980 - 2009

Figure 19: Changes in timing of seasonal flow extremes for rivers in eastern Canada over the past 60 (A,B,C) and 30 (D,E,F) years. Changes are determined for winter low flows (A,D), spring high flows (B,E), and summer low flows (C,F).

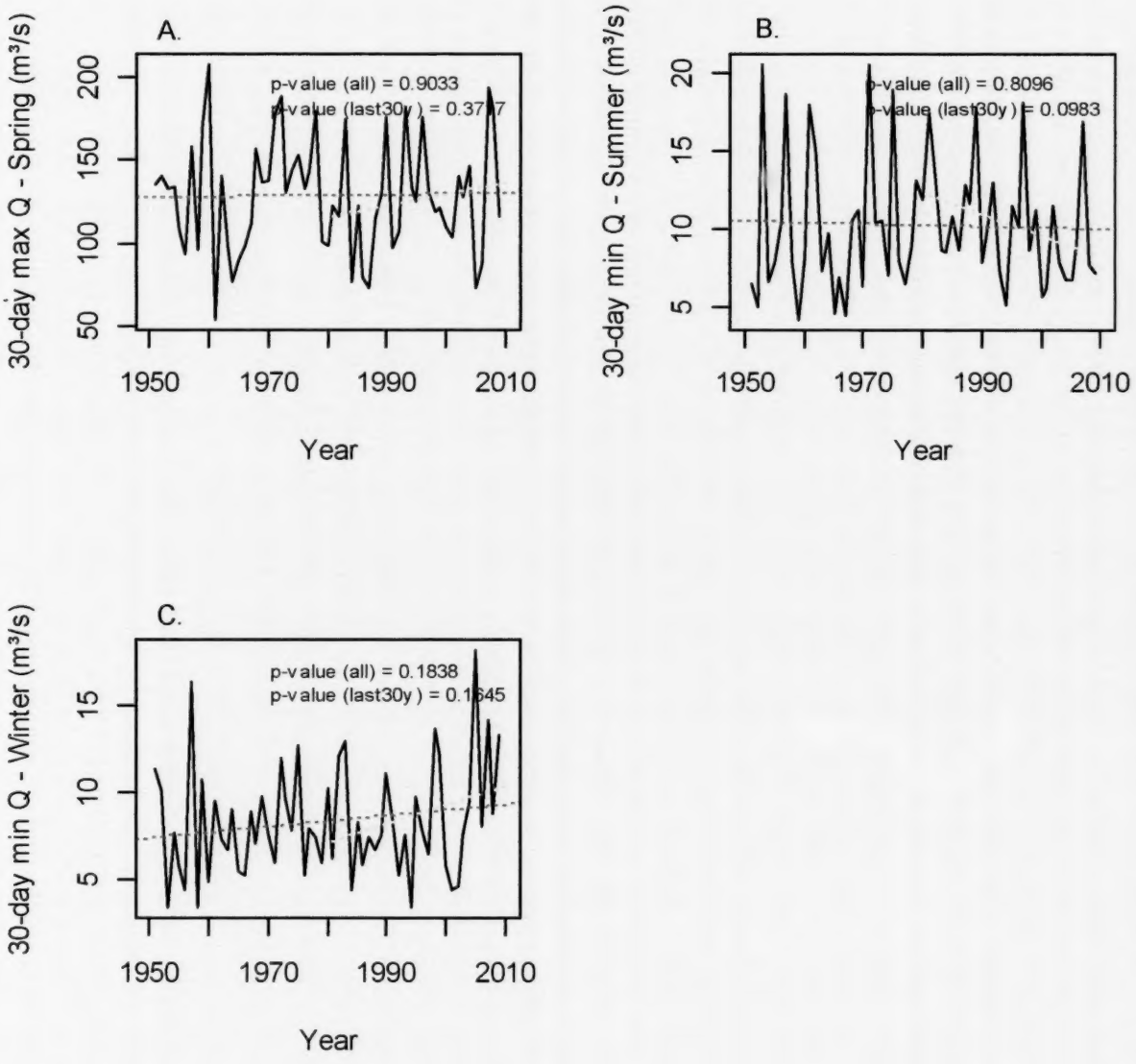

Figure 20: An example of how changes in streamflow magnitude during the A) spring high-flow period, B) summer low-flow period, and C) winter low-flow period were determined using data from the Little Southwest Miramichi River (at Lyttleton), NB. Linear trends were calculated for the past 30 and 60 hydrologic years.

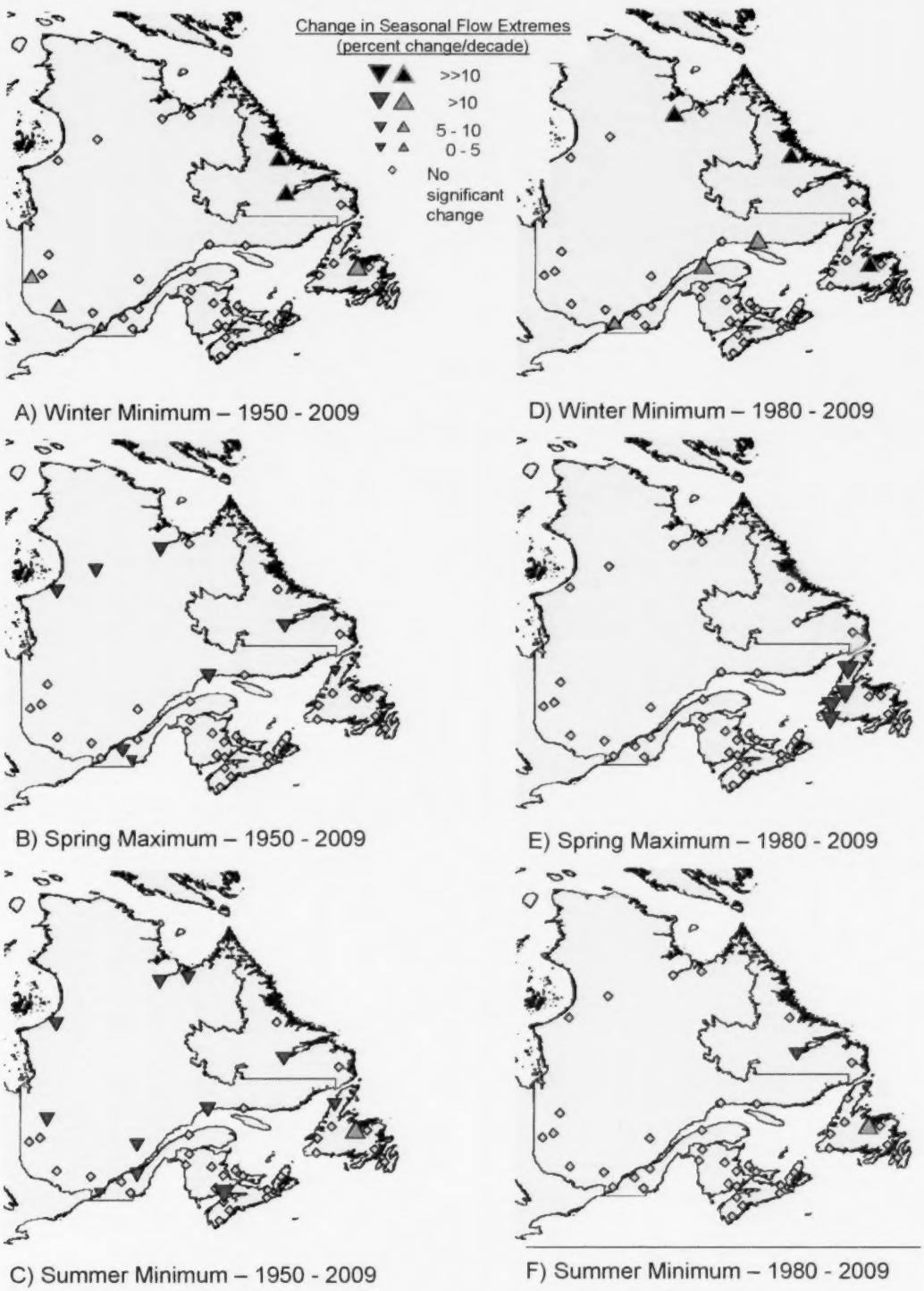
Change in Seasonal Flow Extremes
(percent change/decade)
>>10
>10
5 - 10
0 - 5
No
significant
change
A) Winter Minimum – 1950 - 2009
D) Winter Minimum – 1980 - 2009
B) Spring Maximum – 1950 - 2009
E) Spring Maximum – 1980 - 2009
C) Summer Minimum – 1950 - 2009
F) Summer Minimum – 1980 - 2009

Figure 21: Changes in magnitude of seasonal flow extremes for rivers in eastern Canada over the past 60 (A,B,C) and 30 (D,E,F) years. Changes are determined for winter low flows (A,D), spring high flows (B,E), and summer low flows (C,F).

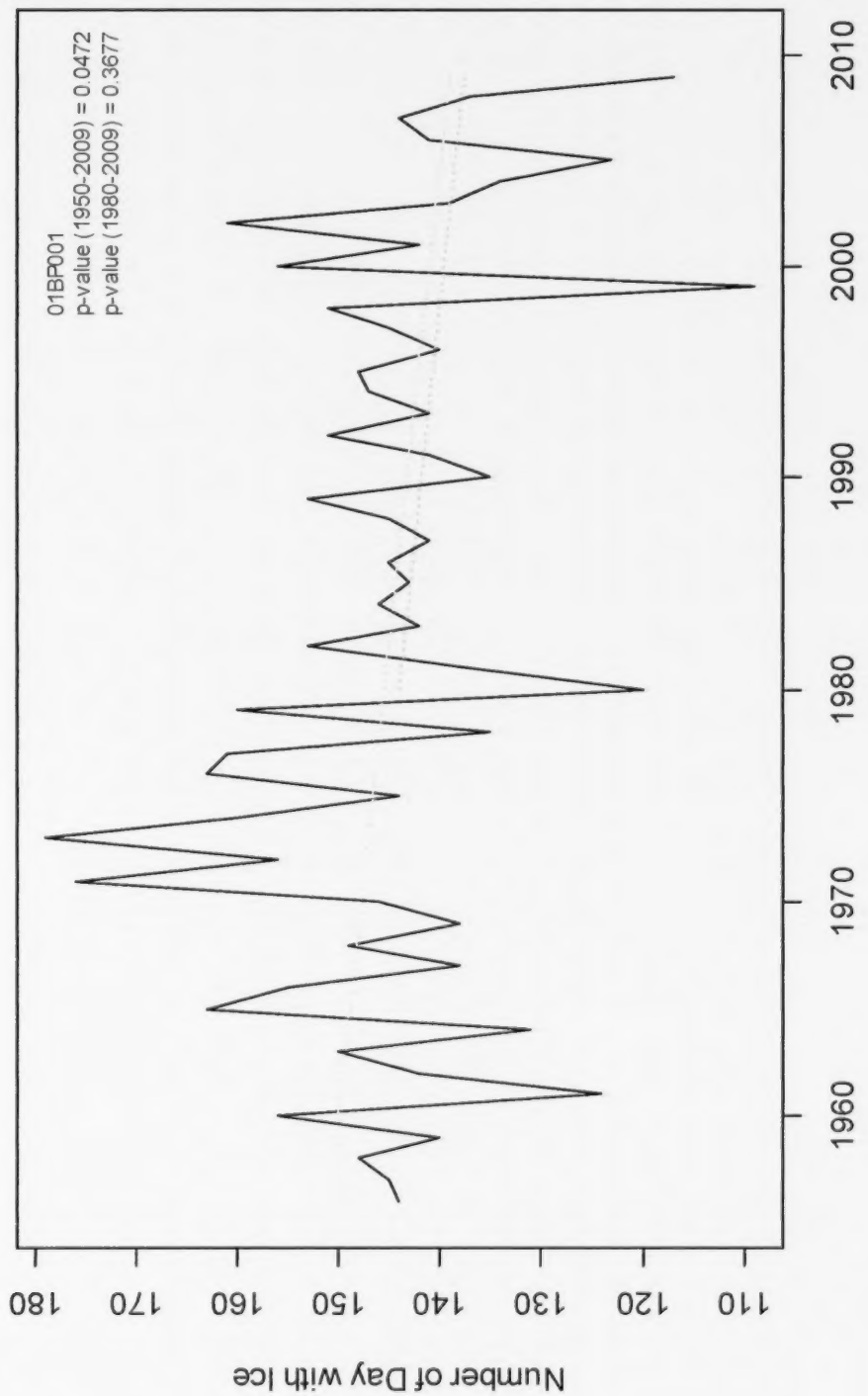

Figure 22: An example of how trends in annual total number of days with ice cover (as determined from backwater correction) were determined using data from the Little Southwest Miramichi River (at Lyttleton). NB. Linear trends were calculated for the past 30 (grey line) and 60 (green line) hydrologic years.

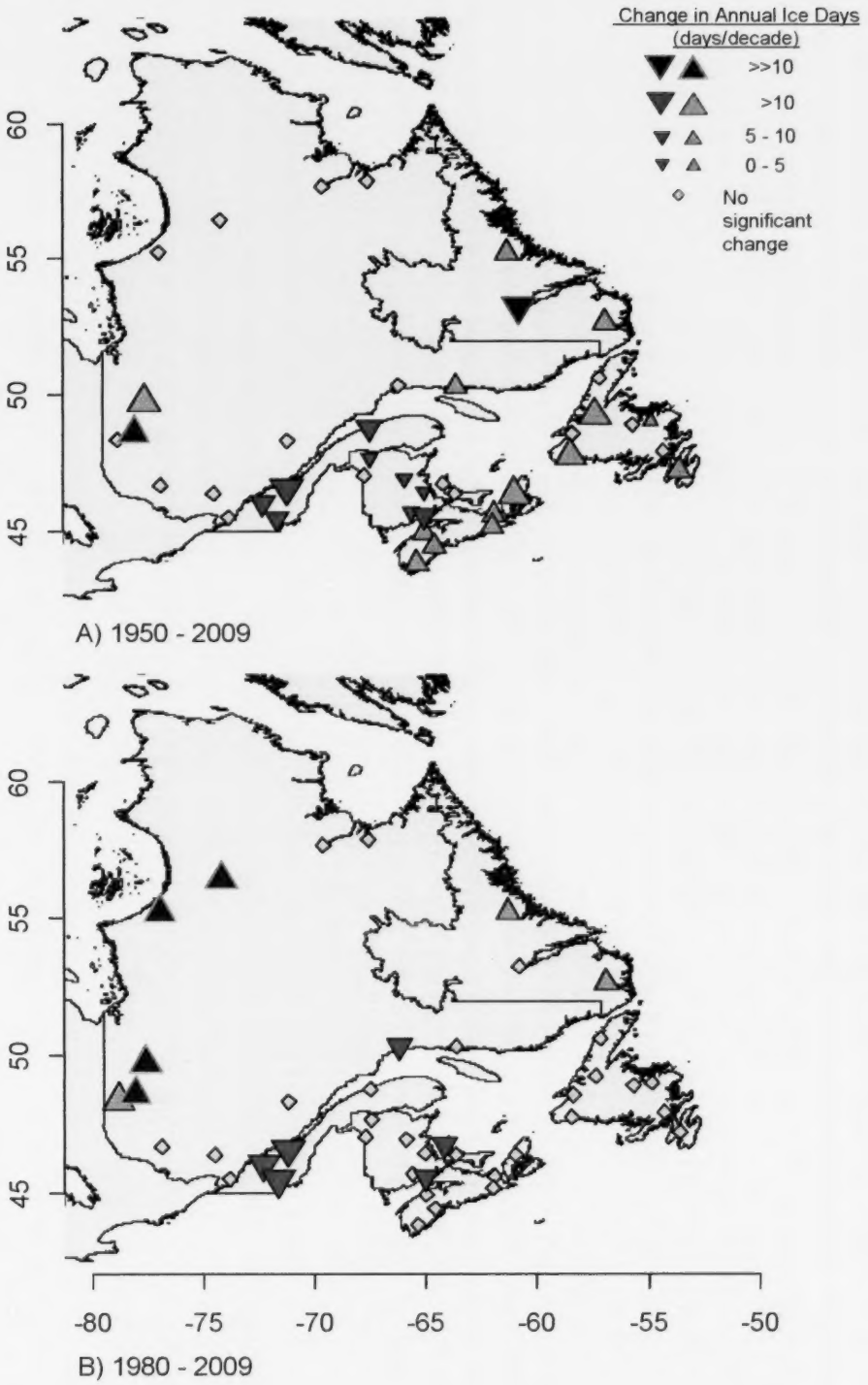

Figure 23: Changes in annual number of ice days, expressed as number of days per decade, for rivers in eastern Canada over the past 60 (A) and 30 (B) years

Appendix A

Results of Statistical Analyses

Table A1: Parameter estimates for trends in mean air temperature for stations in eastern Canada for the past 30 and 60 years. Slopes are given with lower and upper 95% confidence limits (LCL and UCL). Slopes and p-values are determined from linear models with a normal error distribution or from a generalized linear model with a Gamma error distribution as indicated (N or G). Significant changes (p-values < 0.05) are denoted in bold and italics.

Province	Station Name	Season	Period	n	Slope (°C/Year)	p-value	LCL	UCL	Normal or Gamma
NB	Aroostook	Annual	1951 - 2010	46	0.0160	0.5097	-0.0342	0.0663	N
NB	Aroostook	Autumn	1951 - 2010	49	0.0162	***0.0244***	0.0021	0.0302	G
NB	Aroostook	Spring	1951 - 2010	53	0.0194	0.0711	-0.0017	0.0405	N
NB	Aroostook	Summer	1951 - 2010	49	0.0214	***0.0039***	0.0072	0.0356	N
NB	Aroostook	Winter	1951 - 2010	54	-0.0006	0.9644	-0.0286	0.0274	G
NB	Bathurst	Annual	1951 - 2010	46	0.0254	***0.0022***	0.0097	0.0412	N
NB	Bathurst	Autumn	1951 - 2010	51	0.0222	***0.0048***	0.0071	0.0373	N
NB	Bathurst	Spring	1951 - 2010	52	0.0293	***0.0058***	0.0089	0.0497	N
NB	Bathurst	Summer	1951 - 2010	57	0.0253	***0.0006***	0.0113	0.0393	N
NB	Bathurst	Winter	1951 - 2010	50	0.0261	0.0506	-0.0001	0.0523	G
NB	Chatham Miramichi	Annual	1951 - 2010	56	0.0171	***0.0039***	0.0057	0.0284	N
NB	Chatham Miramichi	Autumn	1951 - 2010	59	0.0193	***0.0086***	0.0051	0.0335	N
NB	Chatham Miramichi	Spring	1951 - 2010	59	0.0193	***0.0317***	0.0018	0.0369	N
NB	Chatham Miramichi	Summer	1951 - 2010	59	0.0212	***0.0012***	0.0088	0.0336	N
NB	Chatham Miramichi	Winter	1951 - 2010	59	0.0109	0.3643	-0.0129	0.0346	N
NB	Fredericton	Annual	1951 - 2010	59	0.0119	***0.0190***	0.0020	0.0219	G
NB	Fredericton	Autumn	1951 - 2010	60	0.0088	0.1934	-0.0046	0.0222	N
NB	Fredericton	Spring	1951 - 2010	59	0.0168	***0.0488***	0.0001	0.0336	N
NB	Fredericton	Summer	1951 - 2010	60	0.0128	***0.0186***	0.0022	0.0233	N
NB	Fredericton	Winter	1951 - 2010	60	0.0078	0.4738	-0.0139	0.0295	N
NB	Moncton	Annual	1951 - 2010	60	0.0103	***0.0402***	0.0005	0.0201	G
NB	Moncton	Autumn	1951 - 2010	60	0.0090	0.2001	-0.0049	0.0229	N
NB	Moncton	Spring	1951 - 2010	60	0.0156	0.0663	-0.0011	0.0324	N
NB	Moncton	Summer	1951 - 2010	60	0.0185	***0.0005***	0.0085	0.0285	N
NB	Moncton	Winter	1951 - 2010	60	-0.0029	0.7917	-0.0248	0.0190	N
NB	Saint John	Annual	1951 - 2010	59	0.0113	***0.0256***	0.0014	0.0212	G
NB	Saint John	Autumn	1951 - 2010	59	0.0086	0.1785	-0.0040	0.0212	N
NB	Saint John	Spring	1951 - 2010	59	0.0179	***0.0256***	0.0022	0.0336	G
NB	Saint John	Summer	1951 - 2010	59	0.0155	***0.0010***	0.0065	0.0245	N
NB	Saint John	Winter	1951 - 2010	58	0.0059	0.5922	-0.0161	0.0279	N
NL	Cartwright	Annual	1951 - 2010	60	0.0242	***0.0046***	0.0078	0.0406	N
NL	Cartwright	Autumn	1951 - 2010	60	0.0302	***<0.0001***	0.0164	0.0440	N
NL	Cartwright	Spring	1951 - 2010	60	0.0234	0.0550	-0.0005	0.0474	G
NL	Cartwright	Summer	1951 - 2010	60	0.0283	***0.0001***	0.0144	0.0422	N
NL	Cartwright	Winter	1951 - 2010	60	0.0074	0.6976	-0.0307	0.0456	N
NL	Corner Brook	Annual	1951 - 2010	54	0.0135	0.0550	-0.0003	0.0274	G
NL	Corner Brook	Autumn	1951 - 2010	57	0.0138	***0.0379***	0.0008	0.0268	N
NL	Corner Brook	Spring	1951 - 2010	58	0.0089	0.4084	-0.0124	0.0302	N
NL	Corner Brook	Summer	1951 - 2010	58	0.0270	***0.0002***	0.0132	0.0408	N
NL	Corner Brook	Winter	1951 - 2010	54	-0.0071	0.6291	-0.0367	0.0224	N
NL	Gander	Annual	1951 - 2010	60	0.0070	0.2764	-0.0058	0.0198	N
NL	Gander	Autumn	1951 - 2010	60	0.0102	0.1556	-0.0040	0.0245	N
NL	Gander	Spring	1951 - 2010	60	0.0122	0.2057	-0.0069	0.0312	N

Table A1 (continued)...

Province	Station Name	Season	Period	n	Slope (°C/Year)	p-value	LCL	UCL	Normal or Gamma
NL	Gander	Summer	1951 - 2010	60	0.0101	0.2092	-0.0058	0.0259	N
NL	Gander	Winter	1951 - 2010	60	-0.0097	0.4390	-0.0347	0.0153	N
NL	Goose Bay	Annual	1951 - 2010	60	0.0084	0.3391	-0.0090	0.0258	N
NL	Goose Bay	Autumn	1951 - 2010	60	0.0177	***0.0395***	0.0009	0.0346	N
NL	Goose Bay	Spring	1951 - 2010	60	0.0058	0.6556	-0.0201	0.0317	N
NL	Goose Bay	Summer	1951 - 2010	60	0.0140	***0.0429***	0.0005	0.0276	G
NL	Goose Bay	Winter	1951 - 2010	60	-0.0108	0.5781	-0.0494	0.0278	N
NL	Plum Point	Annual	1951 - 2010	36	0.0479	***0.0061***	0.0146	0.0811	N
NL	Plum Point	Autumn	1951 - 2010	38	0.0533	***0.0002***	0.0270	0.0795	N
NL	Plum Point	Spring	1951 - 2010	36	0.0314	0.1966	-0.0171	0.0799	N
NL	Plum Point	Summer	1951 - 2010	38	0.0448	***0.0010***	0.0193	0.0703	N
NL	Plum Point	Winter	1951 - 2010	37	0.0702	***0.0216***	0.0103	0.1300	G
NL	Port aux Basque	Annual	1951 - 2010	49	0.0159	***0.0138***	0.0032	0.0288	G
NL	Port aux Basque	Autumn	1951 - 2010	53	0.0151	***0.0385***	0.0008	0.0294	N
NL	Port aux Basque	Spring	1951 - 2010	53	0.0162	0.1069	-0.0036	0.0360	N
NL	Port aux Basque	Summer	1951 - 2010	51	0.0387	***<0.0001***	0.0279	0.0496	N
NL	Port aux Basque	Winter	1951 - 2010	52	-0.0007	0.9593	-0.0274	0.0260	N
NL	St. Anthony	Annual	1951 - 2010	47	-0.0211	***0.0037***	-0.0350	-0.0072	N
NL	St. Anthony	Autumn	1951 - 2010	51	-0.0163	***0.0295***	-0.0309	-0.0017	N
NL	St. Anthony	Spring	1951 - 2010	55	-0.0132	0.2371	-0.0353	0.0089	N
NL	St. Anthony	Summer	1951 - 2010	53	-0.0173	***0.0240***	-0.0323	-0.0024	N
NL	St. Anthony	Winter	1951 - 2010	54	-0.0433	***0.0053***	-0.0732	-0.0134	N
NL	St. John's	Annual	1951 - 2010	60	0.0096	0.0606	-0.0004	0.0197	G
NL	St. John's	Autumn	1951 - 2010	60	0.0622	***0.0004***	0.0280	0.0964	G
NL	St. John's	Spring	1951 - 2010	60	0.0145	0.0920	-0.0024	0.0314	G
NL	St. John's	Summer	1951 - 2010	60	0.0183	***0.0153***	0.0037	0.0330	N
NL	St. John's	Winter	1951 - 2010	60	-0.0088	0.3898	-0.0293	0.0116	N
NL	Wabush Lake	Annual	1951 - 2010	48	0.0442	***0.0002***	0.0226	0.0659	N
NL	Wabush Lake	Autumn	1951 - 2010	49	0.0389	***0.0047***	0.0126	0.0653	N
NL	Wabush Lake	Spring	1951 - 2010	50	0.0477	***0.0087***	0.0126	0.0827	N
NL	Wabush Lake	Summer	1951 - 2010	49	0.0376	***<0.0001***	0.0212	0.0541	N
NL	Wabush Lake	Winter	1951 - 2010	50	0.0410	***0.0384***	0.0022	0.0799	G
NS	Collegeville	Annual	1951 - 2010	48	0.0129	***0.0357***	0.0009	0.0249	G
NS	Collegeville	Autumn	1951 - 2010	55	0.0133	0.0827	-0.0017	0.0283	G
NS	Collegeville	Spring	1951 - 2010	55	0.0278	***0.0050***	0.0088	0.0468	N
NS	Collegeville	Summer	1951 - 2010	56	0.0162	***0.0110***	0.0037	0.0286	G
NS	Collegeville	Winter	1951 - 2010	52	0.0084	0.5390	-0.0189	0.0358	N
NS	Halifax	Annual	1951 - 2010	60	0.0077	0.0978	-0.0014	0.0167	G
NS	Halifax	Autumn	1951 - 2010	60	0.0038	0.5281	-0.0082	0.0158	N
NS	Halifax	Spring	1951 - 2010	60	0.0118	0.1001	-0.0023	0.0259	N
NS	Halifax	Summer	1951 - 2010	60	0.0247	***<0.0001***	0.0156	0.0338	N
NS	Halifax	Winter	1951 - 2010	60	-0.0113	0.2160	-0.0294	0.0068	N
NS	Parrsboro	Annual	1951 - 2010	49	0.0250	***0.0012***	0.0104	0.0395	N
NS	Parrsboro	Autumn	1951 - 2010	54	0.0205	***0.0063***	0.0060	0.0350	N
NS	Parrsboro	Spring	1951 - 2010	56	0.0258	***0.0050***	0.0081	0.0435	N
NS	Parrsboro	Summer	1951 - 2010	55	0.0238	***<0.0001***	0.0131	0.0345	N
NS	Parrsboro	Winter	1951 - 2010	53	0.0337	***0.0071***	0.0096	0.0578	N

Table A1 (continued)...

Province	Station Name	Season	Period	n	Slope (°C/Year)	p-value	LCL	UCL	Normal or Gamma
NS	Sable Island	Annual	1951 - 2010	56	0.0070	0.1958	-0.0037	0.0176	N
NS	Sable Island	Autumn	1951 - 2010	58	0.0085	0.1958	-0.0045	0.0215	N
NS	Sable Island	Spring	1951 - 2010	59	0.0132	0.0615	-0.0006	0.0271	G
NS	Sable Island	Summer	1951 - 2010	58	0.0154	***0.0156***	0.0029	0.0278	G
NS	Sable Island	Winter	1951 - 2010	59	-0.0060	0.4629	-0.0221	0.0102	N
NS	Sydney	Annual	1951 - 2010	60	0.0061	0.2785	-0.0051	0.0173	N
NS	Sydney	Autumn	1951 - 2010	60	0.0075	0.2761	-0.0061	0.0211	N
NS	Sydney	Spring	1951 - 2010	60	0.0100	0.2375	-0.0068	0.0267	N
NS	Sydney	Summer	1951 - 2010	60	0.0119	0.0652	-0.0008	0.0245	N
NS	Sydney	Winter	1951 - 2010	60	-0.0083	0.4588	-0.0307	0.0140	N
NS	Yarmouth	Annual	1951 - 2010	59	0.0092	***0.0315***	0.0008	0.0175	G
NS	Yarmouth	Autumn	1951 - 2010	59	0.0064	0.2548	-0.0048	0.0176	N
NS	Yarmouth	Spring	1951 - 2010	60	0.0112	0.1002	-0.0022	0.0245	N
NS	Yarmouth	Summer	1951 - 2010	60	0.0179	***0.0001***	0.0096	0.0262	N
NS	Yarmouth	Winter	1951 - 2010	60	0.0003	0.9736	-0.0161	0.0167	N
PE	Charlottetown	Annual	1951 - 2010	58	0.0129	***0.0127***	0.0028	0.0231	G
PE	Charlottetown	Autumn	1951 - 2010	59	0.0113	0.0879	-0.0017	0.0243	G
PE	Charlottetown	Spring	1951 - 2010	59	0.0209	***0.0221***	0.0031	0.0387	N
PE	Charlottetown	Summer	1951 - 2010	60	0.0173	***0.0016***	0.0068	0.0278	N
PE	Charlottetown	Winter	1951 - 2010	60	-0.0024	0.8302	-0.0248	0.0200	N
QC	Bagotville	Annual	1951 - 2010	59	0.0187	***0.0037***	0.0063	0.0311	N
QC	Bagotville	Autumn	1951 - 2010	60	0.0116	0.1491	-0.0043	0.0274	N
QC	Bagotville	Spring	1951 - 2010	60	0.0156	0.1051	-0.0034	0.0346	N
QC	Bagotville	Summer	1951 - 2010	60	0.0203	***0.0037***	0.0068	0.0337	N
QC	Bagotville	Winter	1951 - 2010	59	0.0260	***0.0455***	0.0005	0.0515	G
QC	Gaspe	Annual	1951 - 2010	41	0.0207	***0.0072***	0.0059	0.0354	N
QC	Gaspe	Autumn	1951 - 2010	51	0.0132	0.0502	0.0000	0.0265	G
QC	Gaspe	Spring	1951 - 2010	48	0.0200	0.0758	-0.0022	0.0422	N
QC	Gaspe	Summer	1951 - 2010	47	0.0187	***0.0082***	0.0051	0.0324	N
QC	Gaspe	Winter	1951 - 2010	48	0.0136	0.3154	-0.0134	0.0407	N
QC	Iles de la Madeleine	Annual	1951 - 2010	54	0.0206	***0.0013***	0.0085	0.0327	N
QC	Iles de la Madeleine	Autumn	1951 - 2010	58	0.0248	***0.0001***	0.0127	0.0370	N
QC	Iles de la Madeleine	Spring	1951 - 2010	56	0.0208	***0.0218***	0.0030	0.0385	G
QC	Iles de la Madeleine	Summer	1951 - 2010	59	0.0328	***<0.0001***	0.0212	0.0444	N
QC	Iles de la Madeleine	Winter	1951 - 2010	54	-0.0018	0.8841	-0.0261	0.0225	N
QC	Inukjuak	Annual	1951 - 2010	53	0.0257	***0.0182***	0.0044	0.0470	G
QC	Inukjuak	Autumn	1951 - 2010	57	0.0313	***0.0040***	0.0104	0.0521	N
QC	Inukjuak	Spring	1951 - 2010	56	0.0148	0.3824	-0.0189	0.0484	N
QC	Inukjuak	Summer	1951 - 2010	58	0.0385	***0.0011***	0.0161	0.0609	N
QC	Inukjuak	Winter	1951 - 2010	54	0.0182	0.3330	-0.0192	0.0556	N
QC	Kuujjuaq	Annual	1951 - 2010	58	0.0273	***0.0086***	0.0072	0.0474	N
QC	Kuujjuaq	Autumn	1951 - 2010	60	0.0341	***0.0024***	0.0126	0.0556	N
QC	Kuujjuaq	Spring	1951 - 2010	59	0.0231	0.1730	-0.0104	0.0565	N
QC	Kuujjuaq	Summer	1951 - 2010	59	0.0272	***0.0002***	0.0133	0.0411	N
QC	Kuujjuaq	Winter	1951 - 2010	59	0.0083	0.6902	-0.0332	0.0499	N
QC	Kuujjuarapik	Annual	1951 - 2010	53	0.0269	***0.0107***	0.0062	0.0475	G
QC	Kuujjuarapik	Autumn	1951 - 2010	55	0.0255	***0.0188***	0.0042	0.0469	G

Table A1 (continued)...

Province	Station Name	Season	Period	n	Slope (°C/Year)	p-value	LCL	UCL	Normal or Gamma
QC	Kuujjuarapik	Spring	1951 - 2010	57	0.0125	0.4789	-0.0227	0.0477	N
QC	Kuujjuarapik	Summer	1951 - 2010	57	0.0389	***0.0002***	0.0192	0.0586	N
QC	Kuujjuarapik	Winter	1951 - 2010	57	0.0153	0.4084	-0.0215	0.0521	N
QC	Maniwaki	Annual	1951 - 2010	51	0.0303	***<0.0001***	0.0176	0.0431	N
QC	Maniwaki	Autumn	1951 - 2010	58	0.0125	0.1535	-0.0048	0.0297	N
QC	Maniwaki	Spring	1951 - 2010	59	0.0274	***0.0101***	0.0068	0.0479	N
QC	Maniwaki	Summer	1951 - 2010	54	0.0195	***0.0148***	0.0040	0.0350	N
QC	Maniwaki	Winter	1951 - 2010	60	0.0374	***0.0086***	0.0099	0.0649	N
QC	Mont Joli	Annual	1951 - 2010	59	0.0151	***0.0080***	0.0041	0.0262	N
QC	Mont Joli	Autumn	1951 - 2010	59	0.0148	***0.0340***	0.0011	0.0285	G
QC	Mont Joli	Spring	1951 - 2010	60	0.0148	0.0755	-0.0016	0.0311	N
QC	Mont Joli	Summer	1951 - 2010	60	0.0186	***0.0082***	0.0050	0.0322	N
QC	Mont Joli	Winter	1951 - 2010	60	0.0084	0.4510	-0.0138	0.0307	N
QC	Montreal Tavish	Annual	1951 - 2010	49	0.0075	0.1550	-0.0029	0.0179	N
QC	Montreal Tavish	Autumn	1951 - 2010	55	0.0009	0.8926	-0.0131	0.0150	N
QC	Montreal Tavish	Spring	1951 - 2010	53	0.0116	0.2135	-0.0069	0.0301	N
QC	Montreal Tavish	Summer	1951 - 2010	53	0.0038	0.5724	-0.0096	0.0172	N
QC	Montreal Tavish	Winter	1951 - 2010	54	0.0162	0.1458	-0.0058	0.0381	N
QC	Natashquan	Annual	1951 - 2010	52	0.0279	***0.0022***	0.0106	0.0452	N
QC	Natashquan	Autumn	1951 - 2010	56	0.0287	***0.0003***	0.0139	0.0434	N
QC	Natashquan	Spring	1951 - 2010	57	0.0142	0.2437	-0.0100	0.0384	N
QC	Natashquan	Summer	1951 - 2010	59	0.0395	***<0.0001***	0.0284	0.0505	N
QC	Natashquan	Winter	1951 - 2010	56	-0.0022	0.8911	-0.0345	0.0301	N
QC	Normandin	Annual	1951 - 2010	53	0.0191	***0.0119***	0.0044	0.0338	N
QC	Normandin	Autumn	1951 - 2010	56	0.0088	0.3285	-0.0091	0.0267	N
QC	Normandin	Spring	1951 - 2010	58	0.0198	0.0813	-0.0025	0.0421	G
QC	Normandin	Summer	1951 - 2010	56	0.0169	***0.0273***	0.0019	0.0319	G
QC	Normandin	Winter	1951 - 2010	58	0.0293	***0.0375***	0.0017	0.0569	G
QC	Quebec City	Annual	1951 - 2010	59	0.0074	0.1619	-0.0031	0.0179	N
QC	Quebec City	Autumn	1951 - 2010	59	0.0040	0.5582	-0.0096	0.0176	N
QC	Quebec City	Spring	1951 - 2010	60	0.0104	0.2368	-0.0070	0.0279	N
QC	Quebec City	Summer	1951 - 2010	60	0.0109	0.0697	-0.0009	0.0227	N
QC	Quebec City	Winter	1951 - 2010	60	0.0031	0.7900	-0.0198	0.0259	N
QC	Schefferville	Annual	1951 - 2010	55	0.0132	0.1353	-0.0042	0.0306	N
QC	Schefferville	Autumn	1951 - 2010	56	0.0266	***0.0095***	0.0068	0.0464	N
QC	Schefferville	Spring	1951 - 2010	58	0.0111	0.4623	-0.0189	0.0410	N
QC	Schefferville	Summer	1951 - 2010	57	0.0202	***0.0088***	0.0053	0.0351	N
QC	Schefferville	Winter	1951 - 2010	57	-0.0126	0.4680	-0.0473	0.0220	N
QC	Sept Iles	Annual	1951 - 2010	59	0.0156	***0.0197***	0.0026	0.0285	N
QC	Sept Iles	Autumn	1951 - 2010	59	0.0198	***0.0041***	0.0065	0.0330	N
QC	Sept Iles	Spring	1951 - 2010	60	0.0123	0.2328	-0.0081	0.0327	N
QC	Sept Iles	Summer	1951 - 2010	60	0.0117	0.0651	-0.0008	0.0241	N
QC	Sept Iles	Winter	1951 - 2010	60	0.0124	0.3983	-0.0168	0.0417	N
QC	Val D'or	Annual	1951 - 2010	53	0.0200	***0.0077***	0.0055	0.0344	N
QC	Val D'or	Autumn	1951 - 2010	57	0.0075	0.4480	-0.0121	0.0271	N
QC	Val D'or	Spring	1951 - 2010	57	0.0171	0.1370	-0.0056	0.0398	N
QC	Val D'or	Summer	1951 - 2010	55	0.0178	***0.0444***	0.0005	0.0352	N

Table A1 (continued)...

Province	Station Name	Season	Period	n	Slope (°C/Year)	p-value	LCL	UCL	Normal or Gamma
QC	Val D'or	Winter	1951 - 2010	55	0.0281	0.0573	-0.0009	0.0570	N
NB	Aroostook	Annual	1981 - 2010	19	0.0160	0.5097	-0.0342	0.0663	N
NB	Aroostook	Autumn	1981 - 2010	24	0.0460	***0.0101***	0.0109	0.0812	G
NB	Aroostook	Spring	1981 - 2010	24	0.0288	0.3573	-0.0347	0.0923	N
NB	Aroostook	Summer	1981 - 2010	21	0.0351	0.1335	-0.0118	0.0820	N
NB	Aroostook	Winter	1981 - 2010	24	0.0665	0.0850	-0.0092	0.1423	G
NB	Bathurst	Annual	1981 - 2010	28	0.0381	***0.0214***	0.0056	0.0709	G
NB	Bathurst	Autumn	1981 - 2010	28	0.0420	***0.0105***	0.0098	0.0741	G
NB	Bathurst	Spring	1981 - 2010	29	0.0306	0.2323	-0.0208	0.0821	N
NB	Bathurst	Summer	1981 - 2010	29	0.0255	0.1974	-0.0141	0.0650	N
NB	Bathurst	Winter	1981 - 2010	29	0.0608	***0.0335***	0.0048	0.1168	G
NB	Chatham Miramichi	Annual	1981 - 2010	26	0.0329	0.1033	-0.0072	0.0731	N
NB	Chatham Miramichi	Autumn	1981 - 2010	29	0.0586	***0.0041***	0.0203	0.0969	N
NB	Chatham Miramichi	Spring	1981 - 2010	29	0.0019	0.9397	-0.0497	0.0535	N
NB	Chatham Miramichi	Summer	1981 - 2010	29	0.0212	0.1997	-0.0119	0.0544	N
NB	Chatham Miramichi	Winter	1981 - 2010	29	0.0608	0.0601	-0.0028	0.1243	N
NB	Fredericton	Annual	1981 - 2010	30	0.0337	***0.0247***	0.0043	0.0631	G
NB	Fredericton	Autumn	1981 - 2010	30	0.0424	***0.0129***	0.0090	0.0759	G
NB	Fredericton	Spring	1981 - 2010	30	0.0275	0.2367	-0.0191	0.0740	N
NB	Fredericton	Summer	1981 - 2010	30	0.0289	***0.0434***	0.0009	0.0570	G
NB	Fredericton	Winter	1981 - 2010	30	0.0490	0.0933	-0.0088	0.1067	N
NB	Moncton	Annual	1981 - 2010	30	0.0395	***0.0091***	0.0099	0.0692	G
NB	Moncton	Autumn	1981 - 2010	30	0.0490	***0.0098***	0.0128	0.0852	N
NB	Moncton	Spring	1981 - 2010	30	0.0247	0.2926	-0.0225	0.0719	N
NB	Moncton	Summer	1981 - 2010	30	0.0405	***0.0041***	0.0140	0.0670	N
NB	Moncton	Winter	1981 - 2010	30	0.0505	0.0652	-0.0032	0.1042	G
NB	Saint John	Annual	1981 - 2010	30	0.0252	0.0830	-0.0033	0.0537	G
NB	Saint John	Autumn	1981 - 2010	30	0.0326	***0.0388***	0.0017	0.0636	G
NB	Saint John	Spring	1981 - 2010	30	0.0276	0.2152	-0.0170	0.0721	N
NB	Saint John	Summer	1981 - 2010	30	0.0241	***0.0387***	0.0013	0.0470	G
NB	Saint John	Winter	1981 - 2010	30	0.0292	0.3195	-0.0298	0.0882	N
NL	Cartwright	Annual	1981 - 2010	30	0.0918	***0.0003***	0.0467	0.1369	N
NL	Cartwright	Autumn	1981 - 2010	30	0.0774	***0.0003***	0.0394	0.1155	N
NL	Cartwright	Spring	1981 - 2010	30	0.0580	0.1058	-0.0131	0.1290	N
NL	Cartwright	Summer	1981 - 2010	30	0.0857	***<0.0001***	0.0529	0.1185	N
NL	Cartwright	Winter	1981 - 2010	30	0.1280	***0.0064***	0.0360	0.2200	G
NL	Corner Brook	Annual	1981 - 2010	26	0.0374	***0.0421***	0.0013	0.0742	G
NL	Corner Brook	Autumn	1981 - 2010	27	0.0406	***0.0057***	0.0118	0.0693	G
NL	Corner Brook	Spring	1981 - 2010	29	0.0035	0.9053	-0.0560	0.0630	N
NL	Corner Brook	Summer	1981 - 2010	28	0.0401	***0.0196***	0.0064	0.0740	G
NL	Corner Brook	Winter	1981 - 2010	26	0.0622	0.0521	-0.0006	0.1251	G
NL	Gander	Annual	1981 - 2010	30	0.0478	***0.0054***	0.0143	0.0815	G
NL	Gander	Autumn	1981 - 2010	30	0.0677	***0.0016***	0.0282	0.1073	N
NL	Gander	Spring	1981 - 2010	30	0.0145	0.6040	-0.0421	0.0710	N
NL	Gander	Summer	1981 - 2010	30	0.0554	***0.0057***	0.0175	0.0933	N
NL	Gander	Winter	1981 - 2010	30	0.0675	***0.0292***	0.0073	0.1276	N
NL	Goose Bay	Annual	1981 - 2010	30	0.0809	***0.0016***	0.0334	0.1284	N

Table A1 (continued)...

Province	Station Name	Season	Period	n	Slope (°C/Year)	p-value	LCL	UCL	Normal or Gamma
NL	Goose Bay	Autumn	1981 - 2010	30	0.0778	***0.0014***	0.0329	0.1227	N
NL	Goose Bay	Spring	1981 - 2010	30	0.0433	0.2444	-0.0313	0.1179	N
NL	Goose Bay	Summer	1981 - 2010	30	0.0725	***0.0001***	0.0415	0.1036	N
NL	Goose Bay	Winter	1981 - 2010	30	0.1173	***0.0094***	0.0288	0.2058	G
NL	Plum Point	Annual	1981 - 2010	28	0.0711	***0.0073***	0.0209	0.1213	N
NL	Plum Point	Autumn	1981 - 2010	29	0.0693	***0.0021***	0.0275	0.1110	N
NL	Plum Point	Spring	1981 - 2010	28	0.0305	0.3918	-0.0415	0.1024	N
NL	Plum Point	Summer	1981 - 2010	30	0.0673	***0.0004***	0.0331	0.1015	N
NL	Plum Point	Winter	1981 - 2010	29	0.1033	***0.0200***	0.0163	0.1903	G
NL	Port aux Basque	Annual	1981 - 2010	24	0.0392	***0.0292***	0.0039	0.0755	G
NL	Port aux Basque	Autumn	1981 - 2010	27	0.0386	***0.0335***	0.0033	0.0740	N
NL	Port aux Basque	Spring	1981 - 2010	28	0.0290	0.2932	-0.0265	0.0845	N
NL	Port aux Basque	Summer	1981 - 2010	26	0.0485	***0.0008***	0.0223	0.0746	N
NL	Port aux Basque	Winter	1981 - 2010	27	0.0579	0.0517	-0.0004	0.1163	G
NL	St. Anthony	Annual	1981 - 2010	23	-0.0502	***0.0075***	-0.0854	-0.0149	N
NL	St. Anthony	Autumn	1981 - 2010	25	-0.0199	0.3917	-0.0669	0.0272	N
NL	St. Anthony	Spring	1981 - 2010	26	-0.0614	***0.0432***	-0.1209	-0.0019	G
NL	St. Anthony	Summer	1981 - 2010	24	-0.0233	0.2084	-0.0606	0.0140	N
NL	St. Anthony	Winter	1981 - 2010	26	-0.0725	***0.0247***	-0.1358	-0.0092	G
NL	St. John's	Annual	1981 - 2010	30	0.0469	***0.0040***	0.0162	0.0776	N
NL	St. John's	Autumn	1981 - 2010	30	0.0623	***0.0013***	0.0265	0.0981	N
NL	St. John's	Spring	1981 - 2010	30	0.0090	0.7279	-0.0435	0.0615	N
NL	St. John's	Summer	1981 - 2010	30	0.0583	***0.0025***	0.0223	0.0943	N
NL	St. John's	Winter	1981 - 2010	30	0.0490	***0.0393***	0.0024	0.0957	G
NL	Wabush Lake	Annual	1981 - 2010	30	0.0718	***0.0039***	0.0251	0.1186	N
NL	Wabush Lake	Autumn	1981 - 2010	30	0.0732	***0.0055***	0.0233	0.1230	N
NL	Wabush Lake	Spring	1981 - 2010	30	0.0503	0.2125	-0.0305	0.1311	N
NL	Wabush Lake	Summer	1981 - 2010	30	0.0486	***0.0010***	0.0214	0.0757	N
NL	Wabush Lake	Winter	1981 - 2010	30	0.1053	***0.0076***	0.0280	0.1826	G
NS	Collegeville	Annual	1981 - 2010	23	0.0366	0.1051	-0.0083	0.0815	N
NS	Collegeville	Autumn	1981 - 2010	27	0.0452	***0.0184***	0.0076	0.0828	G
NS	Collegeville	Spring	1981 - 2010	26	0.0216	0.4302	-0.0340	0.0773	N
NS	Collegeville	Summer	1981 - 2010	27	0.0341	0.0637	-0.0019	0.0702	G
NS	Collegeville	Winter	1981 - 2010	25	0.0876	***0.0162***	0.0162	0.1591	G
NS	Halifax	Annual	1981 - 2010	30	0.0238	0.0834	-0.0031	0.0507	G
NS	Halifax	Autumn	1981 - 2010	30	0.0239	0.1678	-0.0107	0.0586	N
NS	Halifax	Spring	1981 - 2010	30	0.0292	0.1577	-0.0120	0.0705	N
NS	Halifax	Summer	1981 - 2010	30	0.0481	***0.0009***	0.0215	0.0747	N
NS	Halifax	Winter	1981 - 2010	30	0.0003	0.9893	-0.0468	0.0475	N
NS	Parrsboro	Annual	1981 - 2010	26	0.0159	0.3869	-0.0213	0.0531	N
NS	Parrsboro	Autumn	1981 - 2010	26	0.0136	0.4801	-0.0256	0.0529	N
NS	Parrsboro	Spring	1981 - 2010	27	0.0096	0.6753	-0.0369	0.0560	N
NS	Parrsboro	Summer	1981 - 2010	28	0.0107	0.4554	-0.0184	0.0398	N
NS	Parrsboro	Winter	1981 - 2010	27	0.0389	0.1760	-0.0186	0.0965	N
NS	Sable Island	Annual	1981 - 2010	26	0.0204	0.2084	-0.0122	0.0530	N
NS	Sable Island	Autumn	1981 - 2010	28	0.0478	***0.0110***	0.0109	0.0846	G
NS	Sable Island	Spring	1981 - 2010	29	0.0062	0.7709	-0.0368	0.0491	N

Table A1 (continued)...

Province	Station Name	Season	Period	n	Slope (°C/Year)	p-value	LCL	UCL	Normal or Gamma
NS	Sable Island	Summer	1981 - 2010	28	0.0254	0.1729	-0.0118	0.0626	N
NS	Sable Island	Winter	1981 - 2010	29	0.0296	0.1415	-0.0105	0.0696	N
NS	Sydney	Annual	1981 - 2010	30	0.0434	***0.0081***	0.0122	0.0745	N
NS	Sydney	Autumn	1981 - 2010	30	0.0504	***0.0046***	0.0169	0.0838	N
NS	Sydney	Spring	1981 - 2010	30	0.0254	0.2836	-0.0222	0.0730	N
NS	Sydney	Summer	1981 - 2010	30	0.0424	***0.0175***	0.0080	0.0768	N
NS	Sydney	Winter	1981 - 2010	30	0.0539	***0.0321***	0.0046	0.1032	G
NS	Yarmouth	Annual	1981 - 2010	30	0.0225	0.0749	-0.0024	0.0474	N
NS	Yarmouth	Autumn	1981 - 2010	30	0.0315	***0.0377***	0.0019	0.0611	N
NS	Yarmouth	Spring	1981 - 2010	30	0.0074	0.6975	-0.0310	0.0458	N
NS	Yarmouth	Summer	1981 - 2010	30	0.0340	***0.0061***	0.0105	0.0574	N
NS	Yarmouth	Winter	1981 - 2010	30	0.0208	0.3601	-0.0251	0.0667	N
PE	Charlottetown	Annual	1981 - 2010	30	0.0366	***0.0197***	0.0059	0.0673	G
PE	Charlottetown	Autumn	1981 - 2010	30	0.0483	***0.0083***	0.0135	0.0832	N
PE	Charlottetown	Spring	1981 - 2010	30	0.0211	0.3968	-0.0291	0.0712	N
PE	Charlottetown	Summer	1981 - 2010	30	0.0346	***0.0146***	0.0068	0.0624	G
PE	Charlottetown	Winter	1981 - 2010	30	0.0580	***0.0307***	0.0054	0.1105	G
QC	Bagotville	Annual	1981 - 2010	30	0.0469	***0.0114***	0.0106	0.0832	G
QC	Bagotville	Autumn	1981 - 2010	30	0.0562	***0.0048***	0.0186	0.0937	N
QC	Bagotville	Spring	1981 - 2010	30	0.0297	0.2988	-0.0277	0.0870	N
QC	Bagotville	Summer	1981 - 2010	30	0.0370	***0.0452***	0.0008	0.0731	N
QC	Bagotville	Winter	1981 - 2010	30	0.0734	***0.0468***	0.0011	0.1456	N
QC	Gaspe	Annual	1981 - 2010	30	0.0345	***0.0257***	0.0042	0.0649	G
QC	Gaspe	Autumn	1981 - 2010	30	0.0537	***0.0035***	0.0192	0.0883	N
QC	Gaspe	Spring	1981 - 2010	30	0.0046	0.8567	-0.0467	0.0558	N
QC	Gaspe	Summer	1981 - 2010	30	0.0364	***0.0176***	0.0063	0.0664	G
QC	Gaspe	Winter	1981 - 2010	30	0.0579	0.0555	-0.0014	0.1171	G
QC	Iles de la Madeleine	Annual	1981 - 2010	25	0.0703	***0.0005***	0.0341	0.1065	N
QC	Iles de la Madeleine	Autumn	1981 - 2010	28	0.0658	***0.0001***	0.0363	0.0953	N
QC	Iles de la Madeleine	Spring	1981 - 2010	27	0.0537	***0.0473***	0.0006	0.1067	G
QC	Iles de la Madeleine	Summer	1981 - 2010	29	0.0622	***0.0003***	0.0319	0.0926	N
QC	Iles de la Madeleine	Winter	1981 - 2010	25	0.1057	***0.0020***	0.0430	0.1684	N
QC	Inukjuak	Annual	1981 - 2010	25	0.0921	***0.0032***	0.0342	0.1500	N
QC	Inukjuak	Autumn	1981 - 2010	28	0.0755	***0.0061***	0.0235	0.1275	N
QC	Inukjuak	Spring	1981 - 2010	27	0.0994	***0.0429***	0.0032	0.1958	G
QC	Inukjuak	Summer	1981 - 2010	28	0.0932	***0.0032***	0.0341	0.1523	N
QC	Inukjuak	Winter	1981 - 2010	25	0.1120	***0.0134***	0.0232	0.2009	G
QC	Kuujjuaq	Annual	1981 - 2010	30	0.1024	***0.0006***	0.0482	0.1566	N
QC	Kuujjuaq	Autumn	1981 - 2010	30	0.0961	***0.0021***	0.0381	0.1541	N
QC	Kuujjuaq	Spring	1981 - 2010	30	0.1058	***0.0313***	0.0102	0.2013	N
QC	Kuujjuaq	Summer	1981 - 2010	30	0.0644	***0.0007***	0.0300	0.0988	N
QC	Kuujjuaq	Winter	1981 - 2010	30	0.1297	***0.0128***	0.0276	0.2318	G
QC	Kuujjuarapik	Annual	1981 - 2010	28	0.0796	***0.0056***	0.0233	0.1358	G
QC	Kuujjuarapik	Autumn	1981 - 2010	29	0.0805	***0.0043***	0.0276	0.1335	N
QC	Kuujjuarapik	Spring	1981 - 2010	30	0.0891	0.0601	-0.0038	0.1821	G
QC	Kuujjuarapik	Summer	1981 - 2010	29	0.0832	***0.0031***	0.0307	0.1357	N

Table A1 (continued)...

Province	Station Name	Season	Period	n	Slope (°C/Year)	p-value	LCL	UCL	Normal or Gamma
QC	Kuujjuarapik	Winter	1981 - 2010	30	0.1217	***0.0081***	0.0343	0.2091	N
QC	Maniwaki	Annual	1981 - 2010	25	0.0562	***0.0012***	0.0246	0.0878	N
QC	Maniwaki	Autumn	1981 - 2010	30	0.0619	***0.0017***	0.0255	0.0984	N
QC	Maniwaki	Spring	1981 - 2010	30	0.0556	0.0609	-0.0025	0.1137	G
QC	Maniwaki	Summer	1981 - 2010	25	0.0556	***0.0061***	0.0175	0.0937	N
QC	Maniwaki	Winter	1981 - 2010	30	0.0971	*0.0179*	0.0181	0.1761	N
QC	Mont Joli	Annual	1981 - 2010	30	0.0500	***0.0023***	0.0194	0.0805	N
QC	Mont Joli	Autumn	1981 - 2010	30	0.0613	***0.0005***	0.0292	0.0935	N
QC	Mont Joli	Spring	1981 - 2010	30	0.0330	0.1560	-0.0134	0.0794	N
QC	Mont Joli	Summer	1981 - 2010	30	0.0391	***0.0206***	0.0060	0.0721	G
QC	Mont Joli	Winter	1981 - 2010	30	0.0698	***0.0118***	0.0155	0.1242	G
QC	Montreal Tavish	Annual	1981 - 2010	19	0.0062	0.7387	-0.0322	0.0445	N
QC	Montreal Tavish	Autumn	1981 - 2010	25	0.0264	0.0905	-0.0045	0.0574	N
QC	Montreal Tavish	Spring	1981 - 2010	24	0.0090	0.7480	-0.0484	0.0664	N
QC	Montreal Tavish	Summer	1981 - 2010	23	-0.0038	0.8324	-0.0407	0.0331	N
QC	Montreal Tavish	Winter	1981 - 2010	24	0.0340	0.3327	-0.0372	0.1053	N
QC	Natashquan	Annual	1981 - 2010	30	0.0575	***0.0065***	0.0161	0.0989	G
QC	Natashquan	Autumn	1981 - 2010	30	0.0609	***0.0025***	0.0234	0.0984	N
QC	Natashquan	Spring	1981 - 2010	30	0.0264	0.4112	-0.0384	0.0912	N
QC	Natashquan	Summer	1981 - 2010	30	0.0619	***<0.0001***	0.0379	0.0858	N
QC	Natashquan	Winter	1981 - 2010	30	0.0713	0.0666	-0.0049	0.1476	G
QC	Normandin	Annual	1981 - 2010	24	0.0456	***0.0298***	0.0045	0.0868	G
QC	Normandin	Autumn	1981 - 2010	27	0.0551	***0.0113***	0.0125	0.0978	G
QC	Normandin	Spring	1981 - 2010	28	0.0234	0.4690	-0.0420	0.0887	N
QC	Normandin	Summer	1981 - 2010	26	0.0354	0.0735	-0.0034	0.0742	G
QC	Normandin	Winter	1981 - 2010	28	0.0865	***0.0177***	0.0150	0.1579	G
QC	Quebec City	Annual	1981 - 2010	29	0.0161	0.3094	-0.0158	0.0480	N
QC	Quebec City	Autumn	1981 - 2010	29	0.0252	0.1092	-0.0060	0.0565	N
QC	Quebec City	Spring	1981 - 2010	30	0.0117	0.6597	-0.0422	0.0657	N
QC	Quebec City	Summer	1981 - 2010	30	0.0107	0.4884	-0.0205	0.0419	N
QC	Quebec City	Winter	1981 - 2010	30	0.0266	0.4262	-0.0409	0.0941	N
QC	Schefferville	Annual	1981 - 2010	26	0.0574	***0.0219***	0.0083	0.1065	G
QC	Schefferville	Autumn	1981 - 2010	27	0.0684	***0.0076***	0.0182	0.1187	G
QC	Schefferville	Spring	1981 - 2010	28	0.0478	0.2984	-0.0448	0.1405	N
QC	Schefferville	Summer	1981 - 2010	27	0.0559	***0.0044***	0.0192	0.0926	N
QC	Schefferville	Winter	1981 - 2010	27	0.0619	0.1233	-0.0180	0.1418	N
QC	Sept Iles	Annual	1981 - 2010	30	0.0377	0.0741	-0.0037	0.0791	G
QC	Sept Iles	Autumn	1981 - 2010	30	0.0481	***0.0063***	0.0136	0.0825	G
QC	Sept Iles	Spring	1981 - 2010	30	0.0147	0.6358	-0.0482	0.0776	N
QC	Sept Iles	Summer	1981 - 2010	30	0.0070	0.6834	-0.0278	0.0418	N
QC	Sept Iles	Winter	1981 - 2010	30	0.0782	***0.0324***	0.0066	0.1499	G
QC	Val D'or	Annual	1981 - 2010	27	0.0415	0.0592	-0.0016	0.0847	G
QC	Val D'or	Autumn	1981 - 2010	27	0.0601	***0.0227***	0.0084	0.1118	G
QC	Val D'or	Spring	1981 - 2010	28	0.0131	0.7032	-0.0566	0.0827	N
QC	Val D'or	Summer	1981 - 2010	27	0.0472	0.0536	-0.0007	0.0951	G
QC	Val D'or	Winter	1981 - 2010	28	0.0628	0.1516	-0.0246	0.1501	N

Table A2: Parameter estimates for trends in mean air temperature for stations in eastern Canada from 1900 - 2010. Slopes are given with lower and upper 95% confidence limits (LCL and UCL). Slopes and p-values are determined from linear models with a normal error distribution . Significant changes (p-values < 0.05) are denoted in bold and italics.

Province	Station Name	Season	Slope (°C/Year)	p-value	LCL	UCL
QC	Qubec City	Annual	0.0099	***<0.0001***	0.0058	0.0139
QC	Qubec City	Winter	0.0108	***0.0263***	0.0013	0.0202
QC	Qubec City	Spring	0.0115	***0.0015***	0.0045	0.0185
QC	Qubec City	Summer	0.0083	***0.0006***	0.0037	0.0129
QC	Qubec City	Autumn	0.0077	***0.0056***	0.0023	0.0131
QC	Montreal	Annual	0.0202	***<0.0001***	0.0157	0.0248
QC	Montreal	Winter	0.0280	***<0.0001***	0.0177	0.0382
QC	Montreal	Spring	0.0220	***<0.0001***	0.0141	0.0299
QC	Montreal	Summer	0.0133	***<0.0001***	0.0082	0.0184
QC	Montreal	Autumn	0.0173	***<0.0001***	0.0114	0.0233
QC	Maniwaki	Annual	0.0080	***0.0430***	0.0003	0.0157
QC	Maniwaki	Winter	0.0175	***0.0349***	0.0013	0.0336
QC	Maniwaki	Spring	0.0140	***0.0179***	0.0025	0.0255
QC	Maniwaki	Summer	0.0031	0.4840	-0.0057	0.0120
QC	Maniwaki	Autumn	0.0056	0.1951	-0.0029	0.0142
QC	Natashquan	Annual	0.0246	***<0.0001***	0.0177	0.0314
QC	Natashquan	Winter	0.0251	***0.0012***	0.0102	0.0401
QC	Natashquan	Spring	0.0241	***0.0001***	0.0125	0.0357
QC	Natashquan	Summer	0.0213	***<0.0001***	0.0155	0.0270
QC	Natashquan	Autumn	0.0198	***<0.0001***	0.0129	0.0267
QC	Gaspe	Annual	0.0157	***<0.0001***	0.0098	0.0215
QC	Gaspe	Winter	0.0212	***0.0014***	0.0084	0.0340
QC	Gaspe	Spring	0.0196	***0.0011***	0.0081	0.0312
QC	Gaspe	Summer	0.0069	0.1005	-0.0014	0.0151
QC	Gaspe	Autumn	0.0085	***0.0217***	0.0013	0.0157
QC	Mont Joli	Annual	0.0114	***<0.0001***	0.0070	0.0159
QC	Mont Joli	Winter	0.0125	***0.0102***	0.0030	0.0220
QC	Mont Joli	Spring	0.0104	***0.0026***	0.0037	0.0171
QC	Mont Joli	Summer	0.0121	***<0.0001***	0.0067	0.0176
QC	Mont Joli	Autumn	0.0094	***0.0015***	0.0037	0.0151
QC	Bagotville	Annual	0.0223	***<0.0001***	0.0158	0.0289
QC	Bagotville	Winter	0.0295	***<0.0001***	0.0165	0.0425
QC	Bagotville	Spring	0.0262	***<0.0001***	0.0172	0.0351
QC	Bagotville	Summer	0.0172	***<0.0001***	0.0111	0.0233
QC	Bagotville	Autumn	0.0131	***0.0003***	0.0062	0.0200
QC	Kuujjuarapik	Annual	0.0235	***0.0004***	0.0109	0.0361
QC	Kuujjuarapik	Winter	0.0235	***0.0331***	0.0019	0.0450
QC	Kuujjuarapik	Spring	0.0248	***0.0162***	0.0047	0.0449
QC	Kuujjuarapik	Summer	0.0267	***0.0001***	0.0138	0.0396
QC	Kuujjuarapik	Autumn	0.0217	***0.0010***	0.0090	0.0343
NB	Aroostook	Annual	0.0086	0.0549	-0.0002	0.0174
NB	Aroostook	Winter	0.0155	0.0655	-0.0010	0.0321

Table A2 (continued)...

Province	Station Name	Season	Slope (°C/Year)	p-value	LCL	UCL
NB	Aroostook	Spring	0.0303	***<0.0001***	0.0186	0.0420
NB	Aroostook	Summer	0.0116	***0.0158***	0.0023	0.0210
NB	Aroostook	Autumn	0.0109	***0.0248***	0.0014	0.0204
NB	Bathurst	Annual	0.0229	***0.0001***	0.0122	0.0335
NB	Bathurst	Winter	0.0289	***0.0008***	0.0125	0.0453
NB	Bathurst	Spring	0.0219	***<0.0001***	0.0120	0.0319
NB	Bathurst	Summer	0.0120	***0.0124***	0.0027	0.0212
NB	Bathurst	Autumn	0.0153	***0.0006***	0.0069	0.0238
NB	Chatham Miramichi	Annual	0.0211	***<0.0001***	0.0172	0.0251
NB	Chatham Miramichi	Winter	0.0236	***<0.0001***	0.0142	0.0331
NB	Chatham Miramichi	Spring	0.0204	***<0.0001***	0.0137	0.0271
NB	Chatham Miramichi	Summer	0.0222	***<0.0001***	0.0172	0.0271
NB	Chatham Miramichi	Autumn	0.0178	***<0.0001***	0.0125	0.0231
NB	Fredericton	Annual	0.0143	***<0.0001***	0.0103	0.0184
NB	Fredericton	Winter	0.0217	***<0.0001***	0.0121	0.0312
NB	Fredericton	Spring	0.0121	***0.0005***	0.0054	0.0187
NB	Fredericton	Summer	0.0124	***<0.0001***	0.0081	0.0168
NB	Fredericton	Autumn	0.0083	***0.0031***	0.0029	0.0137
NB	Moncton	Annual	0.0083	***0.0001***	0.0043	0.0124
NB	Moncton	Winter	0.0098	***0.0424***	0.0003	0.0192
NB	Moncton	Spring	0.0017	0.6017	-0.0048	0.0082
NB	Moncton	Summer	0.0091	***0.0001***	0.0048	0.0135
NB	Moncton	Autumn	0.0089	***0.0016***	0.0035	0.0144
NB	Saint John	Annual	0.0138	***<0.0001***	0.0100	0.0177
NB	Saint John	Winter	0.0111	***0.0160***	0.0021	0.0200
NB	Saint John	Spring	0.0136	***<0.0001***	0.0078	0.0194
NB	Saint John	Summer	0.0214	***<0.0001***	0.0177	0.0252
NB	Saint John	Autumn	0.0086	***0.0003***	0.0040	0.0132
NL	St. John's	Annual	0.0063	***0.0046***	0.0020	0.0106
NL	St. John's	Winter	0.0041	0.2975	-0.0037	0.0119
NL	St. John's	Spring	0.0048	0.1482	-0.0017	0.0112
NL	St. John's	Summer	0.0134	***0.0001***	0.0068	0.0199
NL	St. John's	Autumn	0.0042	0.1265	-0.0012	0.0097
NL	Port aux Basques	Annual	0.0138	***<0.0001***	0.0084	0.0192
NL	Port aux Basques	Winter	0.0208	***0.0004***	0.0097	0.0319
NL	Port aux Basques	Spring	0.0117	***0.0053***	0.0036	0.0199
NL	Port aux Basques	Summer	0.0112	***0.0004***	0.0052	0.0172
NL	Port aux Basques	Autumn	0.0095	***0.0032***	0.0033	0.0156
NS	Collegeville	Annual	0.0160	***<0.0001***	0.0102	0.0217
NS	Collegeville	Winter	0.0230	***0.0006***	0.0102	0.0357
NS	Collegeville	Spring	0.0194	***0.0002***	0.0097	0.0292
NS	Collegeville	Summer	0.0185	***<0.0001***	0.0120	0.0249
NS	Collegeville	Autumn	0.0105	***0.0057***	0.0031	0.0179
NS	Halifax	Annual	0.0069	***0.0003***	0.0033	0.0106
NS	Halifax	Winter	0.0063	0.1140	-0.0015	0.0142

Table A2 (continued)...

Province	Station Name	Season	Slope (°C/Year)	p-value	LCL	UCL
NS	Halifax	Spring	0.0016	0.5566	-0.0037	0.0069
NS	Halifax	Summer	0.0114	***<0.0001***	0.0072	0.0155
NS	Halifax	Autumn	0.0078	***0.0014***	0.0031	0.0126
NS	Parrsboro	Annual	0.0168	***<0.0001***	0.0116	0.0219
NS	Parrsboro	Winter	0.0217	***0.0001***	0.0116	0.0319
NS	Parrsboro	Spring	0.0150	***0.0001***	0.0076	0.0224
NS	Parrsboro	Summer	0.0178	***<0.0001***	0.0131	0.0224
NS	Parrsboro	Autumn	0.0155	***<0.0001***	0.0101	0.0209
NS	Sable Island	Annual	0.0102	***<0.0001***	0.0062	0.0142
NS	Sable Island	Winter	0.0123	***0.0003***	0.0057	0.0189
NS	Sable Island	Spring	0.0117	***<0.0001***	0.0063	0.0171
NS	Sable Island	Summer	0.0105	***0.0002***	0.0052	0.0158
NS	Sable Island	Autumn	0.0083	***0.0011***	0.0034	0.0132
NS	Sydney	Annual	0.0014	0.5071	-0.0028	0.0056
NS	Sydney	Winter	0.0038	0.4078	-0.0052	0.0128
NS	Sydney	Spring	-0.0008	0.8084	-0.0072	0.0056
NS	Sydney	Summer	0.0042	0.1321	-0.0013	0.0096
NS	Sydney	Autumn	-0.0026	0.3304	-0.0078	0.0026
NS	Yarmouth	Annual	0.0084	***<0.0001***	0.0049	0.0119
NS	Yarmouth	Winter	0.0080	***0.0243***	0.0011	0.0149
NS	Yarmouth	Spring	0.0080	***0.0033***	0.0027	0.0132
NS	Yarmouth	Summer	0.0116	***<0.0001***	0.0079	0.0153
NS	Yarmouth	Autumn	0.0063	***0.0064***	0.0018	0.0109
PE	Charlottetown	Annual	0.0033	0.1172	-0.0009	0.0075
PE	Charlottetown	Winter	0.0084	0.0766	-0.0009	0.0178
PE	Charlottetown	Spring	0.0038	0.2739	-0.0031	0.0107
PE	Charlottetown	Summer	0.0012	0.6322	-0.0037	0.0060
PE	Charlottetown	Autumn	-0.0004	0.8719	-0.0056	0.0047

Table A3: Parameter estimates for trends in total precipitation for stations in eastern Canada for the past 30 and 60 years. Slopes are given with lower and upper 95% confidence limits (LCL and UCL). Slopes and p-values are determined from linear models with a normal error distribution or from a generalized linear model with a Gamma error distribution as indicated (N or G). Significant changes (p-values < 0.05) are denoted in bold and italics.

Province	Station Name	Season	Period	n	Slope (mm/Year)	p-value	LCL	UCL	Normal or Gamma
NB	Aroostook	Annual	1951 - 2010	47	-3.5176	0.4838	-13.8547	6.8195	N
NB	Aroostook	Winter	1951 - 2010	55	1.2227	0.4632	-2.1675	4.6129	N
NB	Aroostook	Spring	1951 - 2010	52	-0.5302	0.7402	-3.8050	2.7447	N
NB	Aroostook	Summer	1951 - 2010	51	-2.2389	0.2605	-6.2718	1.7939	N
NB	Aroostook	Autumn	1951 - 2010	52	0.4324	0.8245	-3.5637	4.4285	N
NB	Aroostook	Annual	1981 - 2010	20	-0.9126	0.5521	-3.9807	2.1555	N
NB	Aroostook	Winter	1981 - 2010	25	-0.2170	0.7295	-1.4686	1.0347	N
NB	Aroostook	Spring	1981 - 2010	24	0.1618	0.7722	-0.9545	1.2781	N
NB	Aroostook	Summer	1981 - 2010	22	-0.4328	0.5015	-1.7172	0.8516	N
NB	Aroostook	Autumn	1981 - 2010	24	-0.3209	0.6133	-1.5881	0.9463	N
NB	Bathurst	Annual	1951 - 2010	53	6.7944	0.1074	-1.5904	15.1792	N
NB	Bathurst	Winter	1951 - 2010	58	1.1813	0.4380	-1.9016	4.2641	N
NB	Bathurst	Spring	1951 - 2010	57	0.9172	0.4587	-1.5864	3.4207	N
NB	Bathurst	Summer	1951 - 2010	59	-1.2046	0.4584	-4.4903	2.0812	N
NB	Bathurst	Autumn	1951 - 2010	56	4.5467	***0.0180***	0.8499	8.2436	N
NB	Bathurst	Annual	1981 - 2010	26	4.2914	***0.0020***	1.6457	6.9370	N
NB	Bathurst	Winter	1981 - 2010	28	0.4515	0.4498	-0.7369	1.6398	N
NB	Bathurst	Spring	1981 - 2010	29	0.7850	0.1276	-0.2318	1.8019	N
NB	Bathurst	Summer	1981 - 2010	29	0.7522	0.1996	-0.4085	1.9130	N
NB	Bathurst	Autumn	1981 - 2010	27	1.8461	***0.0019***	0.7137	2.9785	N
NB	Fredericton	Annual	1951 - 2010	54	-7.0859	0.0553	-14.2456	0.1628	G
NB	Fredericton	Winter	1951 - 2010	55	-1.8212	0.3335	-5.6354	1.9929	N
NB	Fredericton	Spring	1951 - 2010	55	-1.1636	0.5917	-5.5886	3.2613	N
NB	Fredericton	Summer	1951 - 2010	56	-3.7587	***0.0322***	-7.1962	-0.3249	G
NB	Fredericton	Autumn	1951 - 2010	55	-0.2249	0.9150	-4.5363	4.0865	N
NB	Fredericton	Annual	1981 - 2010	24	-0.7685	0.6041	-3.7243	2.1874	N
NB	Fredericton	Winter	1981 - 2010	25	-1.2301	0.0791	-2.6082	0.1481	N
NB	Fredericton	Spring	1981 - 2010	25	1.0631	0.1050	-0.2298	2.3560	N
NB	Fredericton	Summer	1981 - 2010	26	-0.7611	0.2119	-1.9689	0.4467	N
NB	Fredericton	Autumn	1981 - 2010	25	-0.0369	0.9525	-1.2737	1.1999	N
NB	Moncton	Annual	1951 - 2010	59	-0.2605	0.9337	-6.6241	6.1031	N
NB	Moncton	Winter	1951 - 2010	60	-3.1449	0.0937	-6.8578	0.5680	N
NB	Moncton	Spring	1951 - 2010	60	-0.9979	0.5962	-4.8116	2.8158	N
NB	Moncton	Summer	1951 - 2010	60	-0.4640	0.7755	-3.7644	2.8364	N
NB	Moncton	Autumn	1951 - 2010	59	3.7572	***0.0458***	0.0714	7.4431	G
NB	Moncton	Annual	1981 - 2010	26	1.5947	0.2401	-1.0950	4.2845	N
NB	Moncton	Winter	1981 - 2010	30	-1.1143	0.1080	-2.4805	0.2519	N
NB	Moncton	Spring	1981 - 2010	30	0.9281	0.1474	-0.3372	2.1934	N
NB	Moncton	Summer	1981 - 2010	30	0.0995	0.8629	-1.0494	1.2484	N
NB	Moncton	Autumn	1981 - 2010	29	1.4010	***0.0364***	0.0916	2.7105	N
NB	Rexton	Annual	1951 - 2010	50	-5.7413	0.1962	-14.6453	3.1626	N
NB	Rexton	Winter	1951 - 2010	57	-4.0565	***0.0104***	-7.0782	-1.0347	N
NB	Rexton	Spring	1951 - 2010	56	-1.1441	0.5760	-5.2910	3.0028	N
NB	Rexton	Summer	1951 - 2010	58	-0.8689	0.6212	-4.4356	2.6979	N

Table A3 (continued)...

Province	Station Name	Season	Period	n	Slope (mm/Year)	p-value	LCL	UCL	Normal or Gamma
NB	Rexton	Autumn	1951 - 2010	54	1.6540	0.3856	-2.2037	5.5118	N
NB	Rexton	Annual	1981 - 2010	27	0.4336	0.7934	-2.8760	3.7431	N
NB	Rexton	Winter	1981 - 2010	29	-0.8910	0.1758	-2.1928	0.4109	N
NB	Rexton	Spring	1981 - 2010	29	0.2578	0.6901	-1.0317	1.5473	N
NB	Rexton	Summer	1981 - 2010	29	0.4984	0.4159	-0.7197	1.7165	N
NB	Rexton	Autumn	1981 - 2010	27	1.3368	***0.0268***	0.1596	2.5140	N
NB	Saint John	Annual	1951 - 2010	54	-17.6805	***0.0017***	-27.9441	-7.4169	N
NB	Saint John	Winter	1951 - 2010	55	-6.6895	***0.0015***	-10.5271	-2.8519	N
NB	Saint John	Spring	1951 - 2010	55	-3.7060	0.1992	-9.5058	2.0938	N
NB	Saint John	Summer	1951 - 2010	56	-7.9240	***0.0021***	-12.6605	-3.1874	N
NB	Saint John	Autumn	1951 - 2010	55	0.5584	0.8142	-4.2998	5.4166	N
NB	Saint John	Annual	1981 - 2010	24	-6.1925	***0.0022***	-10.0577	-2.3273	N
NB	Saint John	Winter	1981 - 2010	25	-3.6853	***<0.0001***	-5.2908	-2.0798	N
NB	Saint John	Spring	1981 - 2010	25	-0.2925	0.7234	-1.9420	1.3569	N
NB	Saint John	Summer	1981 - 2010	26	-2.1224	***0.0125***	-3.7736	-0.4617	G
NB	Saint John	Autumn	1981 - 2010	25	-0.5477	0.5039	-2.1802	1.0847	N
NL	Cartwright	Annual	1951 - 2010	59	3.2198	0.2908	-2.9051	9.3446	N
NL	Cartwright	Winter	1951 - 2010	60	2.0788	0.3592	-2.4890	6.6466	N
NL	Cartwright	Spring	1951 - 2010	60	-0.4362	0.7886	-3.7366	2.8642	N
NL	Cartwright	Summer	1951 - 2010	60	-0.4372	0.7148	-2.8631	1.9888	N
NL	Cartwright	Autumn	1951 - 2010	59	1.6416	0.2586	-1.2745	4.5577	N
NL	Cartwright	Annual	1981 - 2010	30	4.8035	***0.0006***	2.1572	7.4499	N
NL	Cartwright	Winter	1981 - 2010	30	1.7815	***0.0104***	0.4212	3.1469	G
NL	Cartwright	Spring	1981 - 2010	30	0.2249	0.7524	-1.1954	1.6452	N
NL	Cartwright	Summer	1981 - 2010	30	1.2345	***0.0047***	0.3937	2.0753	N
NL	Cartwright	Autumn	1981 - 2010	30	1.2699	***0.0192***	0.2146	2.3251	N
NL	Corner Brook	Annual	1951 - 2010	57	-0.9353	0.7385	-6.6338	4.7632	N
NL	Corner Brook	Winter	1951 - 2010	56	-1.7509	0.3572	-5.5953	2.0934	N
NL	Corner Brook	Spring	1951 - 2010	59	0.1692	0.9154	-3.0701	3.4085	N
NL	Corner Brook	Summer	1951 - 2010	59	0.1947	0.8914	-2.7048	3.0942	N
NL	Corner Brook	Autumn	1951 - 2010	59	0.9737	0.5296	-2.1637	4.1112	N
NL	Corner Brook	Annual	1981 - 2010	28	3.2936	***0.0038***	1.1111	5.4760	N
NL	Corner Brook	Winter	1981 - 2010	27	0.6424	0.3640	-0.7644	2.0491	N
NL	Corner Brook	Spring	1981 - 2010	29	1.5195	***0.0022***	0.5690	2.4701	N
NL	Corner Brook	Summer	1981 - 2010	29	1.1716	***0.0194***	0.1963	2.1468	N
NL	Corner Brook	Autumn	1981 - 2010	29	0.3768	0.5178	-0.7825	1.5360	N
NL	Gander	Annual	1951 - 2010	60	7.1781	***0.0273***	0.8656	13.4907	N
NL	Gander	Winter	1951 - 2010	60	0.4430	0.8065	-3.2263	4.1122	N
NL	Gander	Spring	1951 - 2010	60	0.9754	0.5680	-2.4820	4.4327	N
NL	Gander	Summer	1951 - 2010	60	2.1737	0.1571	-0.8886	5.2360	N
NL	Gander	Autumn	1951 - 2010	60	3.0223	***0.0318***	0.2653	5.7824	G
NL	Gander	Annual	1981 - 2010	30	5.4929	***<0.0001***	3.1437	7.8422	N
NL	Gander	Winter	1981 - 2010	30	1.7297	***0.0210***	0.2614	3.2077	G
NL	Gander	Spring	1981 - 2010	30	1.0548	0.0824	-0.1399	2.2496	N
NL	Gander	Summer	1981 - 2010	30	1.0168	0.0662	-0.0704	2.1040	N
NL	Gander	Autumn	1981 - 2010	30	1.6969	***0.0009***	0.7218	2.6721	N
NL	Goose Bay	Annual	1951 - 2010	59	-6.6305	***0.0256***	-12.4834	-0.8088	G

Table A3 (continued)...

Province	Station Name	Season	Period	n	Slope (mm/Year)	p-value	LCL	UCL	Normal or Gamma
NL	Goose Bay	Winter	1951 - 2010	60	-2.5255	0.1341	-5.8785	0.8274	N
NL	Goose Bay	Spring	1951 - 2010	60	-1.2553	0.3694	-4.0739	1.5633	N
NL	Goose Bay	Summer	1951 - 2010	59	-1.1449	0.4556	-4.2480	1.9582	N
NL	Goose Bay	Autumn	1951 - 2010	59	-1.3942	0.3231	-4.2364	1.4479	N
NL	Goose Bay	Annual	1981 - 2010	29	-0.1413	0.9002	-2.3888	2.1061	N
NL	Goose Bay	Winter	1981 - 2010	30	-0.2070	0.6924	-1.2494	0.8353	N
NL	Goose Bay	Spring	1981 - 2010	30	0.0573	0.9025	-0.8750	0.9896	N
NL	Goose Bay	Summer	1981 - 2010	29	0.0064	0.9906	-1.0749	1.0877	N
NL	Goose Bay	Autumn	1981 - 2010	29	0.1658	0.7074	-0.7144	1.0461	N
NL	Isle aux Morts	Annual	1951 - 2010	51	15.1929	***0.0332***	1.3494	29.0363	N
NL	Isle aux Morts	Winter	1951 - 2010	53	3.6364	0.3023	-3.5153	10.7882	N
NL	Isle aux Morts	Spring	1951 - 2010	54	6.4005	0.0638	-0.3997	13.2006	N
NL	Isle aux Morts	Summer	1951 - 2010	54	-0.4469	0.8044	-4.1440	3.2502	N
NL	Isle aux Morts	Autumn	1951 - 2010	52	4.6778	0.0579	-0.1575	9.5007	G
NL	Isle aux Morts	Annual	1981 - 2010	21	10.5206	***<0.0001***	7.0928	13.9483	N
NL	Isle aux Morts	Winter	1981 - 2010	23	3.9826	***0.0006***	1.8033	6.1619	N
NL	Isle aux Morts	Spring	1981 - 2010	24	3.7902	***<0.0001***	2.1469	5.4335	N
NL	Isle aux Morts	Summer	1981 - 2010	24	0.8050	0.2444	-0.5670	2.1769	N
NL	Isle aux Morts	Autumn	1981 - 2010	22	1.8208	***0.0178***	0.3154	3.3365	G
NL	Plum Point	Annual	1951 - 2010	36	-3.8567	0.1390	-9.0501	1.3368	N
NL	Plum Point	Winter	1951 - 2010	37	-1.0072	0.5473	-4.3983	2.3839	N
NL	Plum Point	Spring	1951 - 2010	36	-2.6282	0.0623	-5.4013	0.1449	N
NL	Plum Point	Summer	1951 - 2010	38	-1.5256	0.2540	-4.2087	1.1575	N
NL	Plum Point	Autumn	1951 - 2010	38	0.4275	0.7048	-1.8632	2.7182	N
NL	Plum Point	Annual	1981 - 2010	28	-1.5202	0.4028	-5.1664	2.1261	N
NL	Plum Point	Winter	1981 - 2010	29	-0.3767	0.7444	-2.7036	1.9502	N
NL	Plum Point	Spring	1981 - 2010	28	-1.6083	0.1335	-3.7345	0.5178	N
NL	Plum Point	Summer	1981 - 2010	30	0.0909	0.9243	-1.8350	2.0168	N
NL	Plum Point	Autumn	1981 - 2010	29	-0.0171	0.9844	-1.7801	1.7458	N
NL	St. Anthony	Annual	1951 - 2010	43	-15.1058	***0.0029***	-24.2224	-5.9892	N
NL	St. Anthony	Winter	1951 - 2010	48	-3.3739	0.3559	-10.8978	4.1500	N
NL	St. Anthony	Spring	1951 - 2010	45	-3.0697	0.1052	-6.8591	0.7198	N
NL	St. Anthony	Summer	1951 - 2010	46	-5.6643	***0.0034***	-9.0802	-1.9895	G
NL	St. Anthony	Autumn	1951 - 2010	47	-3.5190	0.1772	-8.7920	1.7541	N
NL	St. Anthony	Annual	1981 - 2010	18	9.4876	***0.0005***	4.4383	14.5369	N
NL	St. Anthony	Winter	1981 - 2010	18	4.7506	***<0.0001***	2.6995	6.8017	N
NL	St. Anthony	Spring	1981 - 2010	18	2.6889	***0.0065***	0.7548	4.6128	G
NL	St. Anthony	Summer	1981 - 2010	18	2.5984	***0.0220***	0.3744	4.8386	G
NL	St. Anthony	Autumn	1981 - 2010	19	1.9088	***0.0304***	0.1889	3.6287	N
NL	St. John's	Annual	1951 - 2010	59	4.8397	0.1874	-2.5018	12.1811	N
NL	St. John's	Winter	1951 - 2010	60	4.7673	0.0549	-0.1073	9.6418	N
NL	St. John's	Spring	1951 - 2010	60	2.9737	0.1865	-1.5243	7.4716	N
NL	St. John's	Summer	1951 - 2010	59	-2.2553	0.1495	-5.3742	0.8637	N
NL	St. John's	Autumn	1951 - 2010	60	0.1344	0.9541	-4.6045	4.8733	N
NL	St. John's	Annual	1981 - 2010	29	-1.2532	0.4298	-4.4093	1.9029	N
NL	St. John's	Winter	1981 - 2010	30	-0.4364	0.6328	-2.2549	1.3822	N
NL	St. John's	Spring	1981 - 2010	30	-0.3331	0.6890	-1.9907	1.3245	N

Table A3 (continued)...

Province	Station Name	Season	Period	n	Slope (mm/Year)	p-value	LCL	UCL	Normal or Gamma
NL	St. John's	Summer	1981 - 2010	29	-0.1365	0.8317	-1.4169	1.1439	N
NL	St. John's	Autumn	1981 - 2010	30	0.0473	0.9504	-1.4703	1.5650	N
NL	Wabush Lake	Annual	1951 - 2010	44	5.2354	0.1480	-1.9937	12.4644	N
NL	Wabush Lake	Winter	1951 - 2010	45	1.2698	0.3872	-1.7056	4.2452	N
NL	Wabush Lake	Spring	1951 - 2010	47	-0.5515	0.6727	-3.2087	2.1058	N
NL	Wabush Lake	Summer	1951 - 2010	46	1.6542	0.2223	-1.0678	4.3762	N
NL	Wabush Lake	Autumn	1951 - 2010	45	1.9631	0.2544	-1.5065	5.4327	N
NL	Wabush Lake	Annual	1981 - 2010	26	0.8986	0.5618	-2.2022	3.9993	N
NL	Wabush Lake	Winter	1981 - 2010	26	-0.6037	0.3540	-1.9030	0.6956	N
NL	Wabush Lake	Spring	1981 - 2010	27	0.3565	0.5741	-0.9118	1.6247	N
NL	Wabush Lake	Summer	1981 - 2010	27	0.5405	0.3899	-0.7139	1.7949	N
NL	Wabush Lake	Autumn	1981 - 2010	26	0.2291	0.7467	-1.1921	1.6502	N
NS	Collegeville	Annual	1951 - 2010	42	-15.5090	***0.0074***	-26.4068	-4.6111	N
NS	Collegeville	Winter	1951 - 2010	52	-7.4427	***0.0016***	-11.7664	-3.1189	N
NS	Collegeville	Spring	1951 - 2010	48	-7.2969	***0.0022***	-11.6955	-2.8984	N
NS	Collegeville	Summer	1951 - 2010	54	-2.8183	0.1628	-6.8538	1.2173	N
NS	Collegeville	Autumn	1951 - 2010	53	-2.1283	0.4338	-7.6375	3.3810	N
NS	Collegeville	Annual	1981 - 2010	24	-4.8396	0.0674	-10.0418	0.3625	N
NS	Collegeville	Winter	1981 - 2010	26	-3.7301	***0.0001***	-5.4486	-2.0117	N
NS	Collegeville	Spring	1981 - 2010	26	-1.3579	0.1647	-3.2937	0.5779	N
NS	Collegeville	Summer	1981 - 2010	27	0.3941	0.6363	-1.2683	2.0564	N
NS	Collegeville	Autumn	1981 - 2010	27	0.8418	0.3533	-0.9624	2.6461	N
NS	Demming	Annual	1951 - 2010	52	-0.1399	0.9741	-8.9535	8.6736	N
NS	Demming	Winter	1951 - 2010	57	-1.5221	0.2854	-4.3902	1.3461	N
NS	Demming	Spring	1951 - 2010	54	-2.3538	0.2224	-6.2241	1.5164	N
NS	Demming	Summer	1951 - 2010	54	-0.0799	0.9688	-4.2488	4.0890	N
NS	Demming	Autumn	1951 - 2010	57	0.3508	0.8955	-5.0839	5.7854	N
NS	Demming	Annual	1981 - 2010	26	1.6422	0.2952	-1.4759	4.7604	N
NS	Demming	Winter	1981 - 2010	28	-0.3761	0.5613	-1.6657	0.9135	N
NS	Demming	Spring	1981 - 2010	28	0.9023	0.2361	-0.6082	2.4128	N
NS	Demming	Summer	1981 - 2010	27	-0.4337	0.5974	-2.0712	1.2039	N
NS	Demming	Autumn	1981 - 2010	28	0.9792	0.2279	-0.6303	2.5886	N
NS	Greenwood	Annual	1951 - 2010	59	0.1956	0.9490	-6.0219	6.4130	N
NS	Greenwood	Winter	1951 - 2010	60	0.2576	0.8482	-2.4730	2.9882	N
NS	Greenwood	Spring	1951 - 2010	60	-1.4252	0.3654	-4.5981	1.7478	N
NS	Greenwood	Summer	1951 - 2010	60	-0.6410	0.7251	-4.3378	3.0559	N
NS	Greenwood	Autumn	1951 - 2010	59	1.9483	0.3195	-1.9936	5.8902	N
NS	Greenwood	Annual	1981 - 2010	29	0.7568	0.5457	-1.7362	3.2498	N
NS	Greenwood	Winter	1981 - 2010	30	-0.6252	0.2798	-1.7723	0.5218	N
NS	Greenwood	Spring	1981 - 2010	30	0.5658	0.2747	-0.4613	1.5930	N
NS	Greenwood	Summer	1981 - 2010	30	0.0725	0.9018	-1.0990	1.2441	N
NS	Greenwood	Autumn	1981 - 2010	29	0.7430	0.2430	-0.5182	2.0043	N
NS	Halifax	Annual	1951 - 2010	58	1.4394	0.6613	-5.2367	8.1155	N
NS	Halifax	Winter	1951 - 2010	60	0.1531	0.9230	-3.0608	3.3669	N
NS	Halifax	Spring	1951 - 2010	60	-0.7404	0.7064	-4.7252	3.2445	N
NS	Halifax	Summer	1951 - 2010	58	-0.8713	0.7338	-6.0809	4.3384	N
NS	Halifax	Autumn	1951 - 2010	59	0.9919	0.6699	-3.7299	5.7137	N
NS	Halifax	Annual	1981 - 2010	28	1.1187	0.4791	-2.0265	4.2638	N

Table A3 (continued)...

Province	Station Name	Season	Period	n	Slope (mm/Year)	p-value	LCL	UCL	Normal or Gamma
NS	Halifax	Winter	1981 - 2010	30	-1.3746	***0.0203***	-2.5398	-0.2137	G
NS	Halifax	Spring	1981 - 2010	30	0.6153	0.3582	-0.7145	1.9451	N
NS	Halifax	Summer	1981 - 2010	28	0.9596	0.2191	-0.5872	2.5063	N
NS	Halifax	Autumn	1981 - 2010	29	0.3987	0.5983	-1.1083	1.9056	N
NS	Sydney	Annual	1951 - 2010	57	-6.2851	0.2023	-16.1709	3.6008	N
NS	Sydney	Winter	1951 - 2010	59	-3.5425	0.0581	-7.2093	0.1225	G
NS	Sydney	Spring	1951 - 2010	59	-4.0096	0.0588	-8.1746	0.1501	G
NS	Sydney	Summer	1951 - 2010	59	-0.5569	0.7736	-4.4893	3.3755	N
NS	Sydney	Autumn	1951 - 2010	58	1.2655	0.6106	-3.7810	6.3119	N
NS	Sydney	Annual	1981 - 2010	27	1.7079	0.2615	-1.3088	4.7245	N
NS	Sydney	Winter	1981 - 2010	29	-0.5313	0.5308	-2.2185	1.1559	N
NS	Sydney	Spring	1981 - 2010	29	0.2481	0.7456	-1.2758	1.7721	N
NS	Sydney	Summer	1981 - 2010	29	0.1037	0.8691	-1.1512	1.3587	N
NS	Sydney	Autumn	1981 - 2010	28	1.7679	***0.0206***	0.2816	3.2542	N
NS	Yarmouth	Annual	1951 - 2010	58	1.9750	0.6014	-5.6913	9.6413	N
NS	Yarmouth	Winter	1951 - 2010	60	-0.3412	0.8301	-3.5685	2.8861	N
NS	Yarmouth	Spring	1951 - 2010	60	-0.7069	0.7648	-5.4991	4.0853	N
NS	Yarmouth	Summer	1951 - 2010	59	-0.9614	0.6211	-4.9061	2.9833	N
NS	Yarmouth	Autumn	1951 - 2010	59	3.0311	0.1353	-1.0059	7.0680	N
NS	Yarmouth	Annual	1981 - 2010	29	-0.1096	0.9400	-3.0151	2.7958	N
NS	Yarmouth	Winter	1981 - 2010	30	-0.9441	0.1250	-2.1583	0.2700	N
NS	Yarmouth	Spring	1981 - 2010	30	0.4911	0.4673	-0.8524	1.8345	N
NS	Yarmouth	Summer	1981 - 2010	29	-0.3237	0.6229	-1.6346	0.9872	N
NS	Yarmouth	Autumn	1981 - 2010	30	0.4717	0.5512	-1.1037	2.0471	N
PE	Charlottetown	Annual	1951 - 2010	56	-6.1643	0.1443	-14.5874	2.2589	N
PE	Charlottetown	Winter	1951 - 2010	60	-0.2941	0.8730	-4.0291	3.4409	N
PE	Charlottetown	Spring	1951 - 2010	59	-2.6668	0.1172	-6.0478	0.7141	N
PE	Charlottetown	Summer	1951 - 2010	58	-0.4951	0.7665	-3.8862	2.8959	N
PE	Charlottetown	Autumn	1951 - 2010	57	-0.7517	0.7228	-5.0598	3.5565	N
PE	Charlottetown	Annual	1981 - 2010	27	-1.4404	0.2936	-4.1632	1.2823	N
PE	Charlottetown	Winter	1981 - 2010	30	-0.9908	0.1658	-2.4040	0.4224	N
PE	Charlottetown	Spring	1981 - 2010	29	-0.3078	0.6225	-1.5529	0.9373	N
PE	Charlottetown	Summer	1981 - 2010	28	0.1249	0.8251	-1.0015	1.2512	N
PE	Charlottetown	Autumn	1981 - 2010	28	0.1887	0.7715	-1.1073	1.4848	N
QC	Bagotville	Annual	1951 - 2010	59	0.6585	0.7732	-3.9823	5.2993	N
QC	Bagotville	Winter	1951 - 2010	60	0.2718	0.8157	-2.0951	2.6387	N
QC	Bagotville	Spring	1951 - 2010	60	-1.9704	0.1277	-4.5414	0.6006	N
QC	Bagotville	Summer	1951 - 2010	60	-0.1419	0.9086	-2.6500	2.3662	N
QC	Bagotville	Autumn	1951 - 2010	59	1.6748	0.1701	-0.7631	4.1127	N
QC	Bagotville	Annual	1981 - 2010	29	0.4465	0.6101	-1.2972	2.1901	N
QC	Bagotville	Winter	1981 - 2010	30	-0.3690	0.4144	-1.2675	0.5295	N
QC	Bagotville	Spring	1981 - 2010	30	0.6200	0.1419	-0.2134	1.4534	N
QC	Bagotville	Summer	1981 - 2010	30	-0.6068	0.1642	-1.4690	0.2554	N
QC	Bagotville	Autumn	1981 - 2010	29	0.5868	0.1683	-0.2552	1.4289	N
QC	Gaspe	Annual	1951 - 2010	43	5.9190	0.2338	-4.0628	15.9009	N
QC	Gaspe	Winter	1951 - 2010	53	-0.3822	0.8281	-3.9542	3.1897	N
QC	Gaspe	Spring	1951 - 2010	50	0.3118	0.8763	-3.7552	4.3789	N
QC	Gaspe	Summer	1951 - 2010	53	-1.4137	0.3218	-4.2845	1.4572	N

Table A3 (continued)...

Province	Station Name	Season	Period	n	Slope (mm/Year)	p-value	LCL	UCL	Normal or Gamma
QC	Gaspe	Autumn	1951 - 2010	55	4.4742	***0.0488***	0.0247	8.9806	G
QC	Gaspe	Annual	1981 - 2010	28	3.9493	***0.0484***	0.0290	7.8695	N
QC	Gaspe	Winter	1981 - 2010	30	-1.1513	0.1093	-2.5694	0.2667	N
QC	Gaspe	Spring	1981 - 2010	30	1.7993	***0.0381***	0.1010	3.4458	G
QC	Gaspe	Summer	1981 - 2010	30	-0.5536	0.3630	-1.7642	0.6571	N
QC	Gaspe	Autumn	1981 - 2010	28	2.8585	***0.0001***	1.5309	4.1861	N
QC	Iles de la Madeleine	Annual	1951 - 2010	47	-7.6567	0.1929	-19.5713	4.2579	N
QC	Iles de la Madeleine	Winter	1951 - 2010	51	-5.9613	***0.0227***	-11.1633	-0.8344	G
QC	Iles de la Madeleine	Spring	1951 - 2010	50	-0.3125	0.8807	-4.6109	3.9859	N
QC	Iles de la Madeleine	Summer	1951 - 2010	52	-1.7183	0.3933	-5.8266	2.3900	N
QC	Iles de la Madeleine	Autumn	1951 - 2010	50	3.6968	0.1407	-1.3357	8.7293	N
QC	Iles de la Madeleine	Annual	1981 - 2010	19	5.5272	***0.0060***	1.6709	9.3834	N
QC	Iles de la Madeleine	Winter	1981 - 2010	22	1.5757	0.1467	-0.5716	3.7229	N
QC	Iles de la Madeleine	Spring	1981 - 2010	21	1.8872	***0.0323***	0.1597	3.6240	G
QC	Iles de la Madeleine	Summer	1981 - 2010	22	0.6657	0.2048	-0.3751	1.7064	N
QC	Iles de la Madeleine	Autumn	1981 - 2010	21	2.3131	***0.0010***	0.9878	3.6384	N
QC	Kuujjuaq	Annual	1951 - 2010	52	5.3981	***0.0069***	1.4815	9.3347	G
QC	Kuujjuaq	Winter	1951 - 2010	53	-0.6712	0.6915	-4.1402	2.7977	N
QC	Kuujjuaq	Spring	1951 - 2010	53	0.3559	0.6958	-1.5071	2.2188	N
QC	Kuujjuaq	Summer	1951 - 2010	53	2.5941	***0.0166***	0.5193	4.6688	N
QC	Kuujjuaq	Autumn	1951 - 2010	53	2.1237	0.1893	-1.1316	5.3790	N
QC	Kuujjuaq	Annual	1981 - 2010	23	1.8473	0.0561	-0.0483	3.7521	G
QC	Kuujjuaq	Winter	1981 - 2010	23	-0.0606	0.9164	-1.2137	1.0926	N
QC	Kuujjuaq	Spring	1981 - 2010	24	0.4626	0.1399	-0.1567	1.0819	N
QC	Kuujjuaq	Summer	1981 - 2010	24	0.4931	0.1856	-0.2447	1.2309	N
QC	Kuujjuaq	Autumn	1981 - 2010	23	1.0289	***0.0212***	0.1540	1.9134	G
QC	Kuujjuarapik	Annual	1951 - 2010	47	-0.3680	0.8537	-4.4761	3.7401	N
QC	Kuujjuarapik	Winter	1951 - 2010	50	0.6572	0.4618	-1.1662	2.4806	N
QC	Kuujjuarapik	Spring	1951 - 2010	53	-0.1097	0.8974	-1.8493	1.6299	N
QC	Kuujjuarapik	Summer	1951 - 2010	51	0.6431	0.6829	-2.5854	3.8717	N
QC	Kuujjuarapik	Autumn	1951 - 2010	50	0.1384	0.9024	-2.1754	2.4523	N
QC	Kuujjuarapik	Annual	1981 - 2010	22	0.1153	0.8981	-1.6881	1.9186	N
QC	Kuujjuarapik	Winter	1981 - 2010	23	0.1216	0.8063	-0.8700	1.1132	N
QC	Kuujjuarapik	Spring	1981 - 2010	25	-0.4427	0.1177	-1.0011	0.1157	N
QC	Kuujjuarapik	Summer	1981 - 2010	23	-0.6796	0.2224	-1.7847	0.4255	N
QC	Kuujjuarapik	Autumn	1981 - 2010	24	1.2837	***0.0111***	0.2940	2.2752	G
QC	Lac Berry	Annual	1951 - 2010	50	-8.8081	***0.0031***	-14.5251	-3.0030	G
QC	Lac Berry	Winter	1951 - 2010	57	-1.1216	0.2646	-3.1416	0.8985	N
QC	Lac Berry	Spring	1951 - 2010	57	-2.9184	***0.0023***	-4.6970	-1.1397	N
QC	Lac Berry	Summer	1951 - 2010	58	-0.7696	0.6079	-3.8117	2.2725	N
QC	Lac Berry	Autumn	1951 - 2010	54	-1.6741	0.2783	-4.7891	1.4409	N
QC	Lac Berry	Annual	1981 - 2010	24	0.1562	0.8894	-2.0902	2.4026	N
QC	Lac Berry	Winter	1981 - 2010	29	-0.6554	***0.0402***	-1.2803	-0.0305	N
QC	Lac Berry	Spring	1981 - 2010	29	0.8774	***0.0224***	0.1251	1.6224	G
QC	Lac Berry	Summer	1981 - 2010	29	-0.3289	0.5831	-1.5225	0.8647	N
QC	Lac Berry	Autumn	1981 - 2010	26	0.3572	0.4696	-0.6267	1.3411	N
QC	Les Buissons	Annual	1951 - 2010	40	0.9504	0.8153	-7.4030	9.3038	N

Table A3 (continued)...

Province	Station Name	Season	Period	n	Slope (mm/Year)	p-value	LCL	UCL	Normal or Gamma
QC	Les Buissons	Winter	1951 - 2010	48	-2.9165	0.0623	-5.9937	0.1606	N
QC	Les Buissons	Spring	1951 - 2010	48	-1.8076	0.3586	-5.7996	2.1843	N
QC	Les Buissons	Summer	1951 - 2010	50	2.4615	0.1395	-0.8576	5.7807	N
QC	Les Buissons	Autumn	1951 - 2010	53	2.3864	0.1699	-1.0888	5.8615	N
QC	Les Buissons	Annual	1981 - 2010	23	2.7616	0.1253	-0.8049	6.3280	N
QC	Les Buissons	Winter	1981 - 2010	28	-0.8239	0.3464	-2.5671	0.9194	N
QC	Les Buissons	Spring	1981 - 2010	25	1.1399	0.1273	-0.3375	2.6172	N
QC	Les Buissons	Summer	1981 - 2010	28	1.3121	***0.0307***	0.1234	2.4836	G
QC	Les Buissons	Autumn	1981 - 2010	28	1.6224	***0.0051***	0.5109	2.7339	N
QC	Montreal PET	Annual	1951 - 2010	60	5.5697	0.0702	-0.4917	11.6311	N
QC	Montreal PET	Winter	1951 - 2010	60	2.3048	0.0740	-0.2393	4.8490	N
QC	Montreal PET	Spring	1951 - 2010	60	1.5531	0.2366	-1.0775	4.1837	N
QC	Montreal PET	Summer	1951 - 2010	60	0.8095	0.5712	-2.0840	3.7031	N
QC	Montreal PET	Autumn	1951 - 2010	60	0.6743	0.6898	-2.7506	4.0992	N
QC	Montreal PET	Annual	1981 - 2010	30	0.7896	0.4638	-1.3536	2.9328	N
QC	Montreal PET	Winter	1981 - 2010	30	-0.5443	0.2854	-1.5549	0.4662	N
QC	Montreal PET	Spring	1981 - 2010	30	0.5458	0.2210	-0.3373	1.4289	N
QC	Montreal PET	Summer	1981 - 2010	30	-0.0152	0.9742	-0.9504	0.9200	N
QC	Montreal PET	Autumn	1981 - 2010	30	0.7374	0.1943	-0.3866	1.8613	N
QC	Natashquan	Annual	1951 - 2010	44	-0.4734	0.9414	-13.7360	12.7892	N
QC	Natashquan	Winter	1951 - 2010	51	-0.6033	0.7633	-4.7156	3.5091	N
QC	Natashquan	Spring	1951 - 2010	48	-0.1072	0.9741	-6.8984	6.6839	N
QC	Natashquan	Summer	1951 - 2010	51	0.6318	0.7866	-4.1709	5.4346	N
QC	Natashquan	Autumn	1951 - 2010	49	-0.2526	0.9251	-5.7866	5.2815	N
QC	Natashquan	Annual	1981 - 2010	22	0.2657	0.8827	-3.3469	3.8782	N
QC	Natashquan	Winter	1981 - 2010	23	-0.1197	0.8441	-1.3361	1.0967	N
QC	Natashquan	Spring	1981 - 2010	22	0.7922	0.3040	-0.7418	2.3261	N
QC	Natashquan	Summer	1981 - 2010	22	-0.3972	0.4942	-1.5559	0.7615	N
QC	Natashquan	Autumn	1981 - 2010	22	-0.1571	0.8320	-1.6381	1.3239	N
QC	Rimouski	Annual	1951 - 2010	46	4.6037	0.1426	-1.6588	10.8662	N
QC	Rimouski	Winter	1951 - 2010	54	0.9030	0.5102	-1.8735	3.6795	N
QC	Rimouski	Spring	1951 - 2010	52	0.3018	0.8011	-2.1362	2.7398	N
QC	Rimouski	Summer	1951 - 2010	54	0.2267	0.8948	-3.2563	3.7096	N
QC	Rimouski	Autumn	1951 - 2010	56	2.5111	0.0811	-0.3140	5.3300	G
QC	Rimouski	Annual	1981 - 2010	27	4.4386	***0.0004***	2.1085	6.7687	N
QC	Rimouski	Winter	1981 - 2010	29	0.4479	0.4133	-0.6420	1.5378	N
QC	Rimouski	Spring	1981 - 2010	28	1.2907	***0.0097***	0.3268	2.2547	N
QC	Rimouski	Summer	1981 - 2010	29	1.0564	0.1033	-0.2222	2.3350	N
QC	Rimouski	Autumn	1981 - 2010	28	1.6349	***0.0021***	0.6209	2.6489	N
QC	Sept Iles	Annual	1951 - 2010	49	0.4721	0.9407	-12.6695	13.6138	N
QC	Sept Iles	Winter	1951 - 2010	56	-1.6595	0.3866	-5.5435	2.2244	N
QC	Sept Iles	Spring	1951 - 2010	51	-3.9935	0.1670	-9.8100	1.8230	N
QC	Sept Iles	Summer	1951 - 2010	51	1.1105	0.7255	-5.4123	7.6334	N
QC	Sept Iles	Autumn	1951 - 2010	49	2.7058	0.3160	-2.8060	8.2176	N
QC	Sept Iles	Annual	1981 - 2010	20	0.3245	0.8536	-3.1947	3.8438	N
QC	Sept Iles	Winter	1981 - 2010	26	-0.9964	0.1816	-2.4725	0.4798	N
QC	Sept Iles	Spring	1981 - 2010	21	0.8835	0.3015	-0.8168	2.5838	N
QC	Sept Iles	Summer	1981 - 2010	21	-0.1408	0.8457	-1.5864	1.3049	N

Table A3 (continued)...

Province	Station Name	Season	Period	n	Slope (mm/Year)	p-value	LCL	UCL	Normal or Gamma
QC	Sept Iles	Autumn	1981 - 2010	20	0.5307	0.4834	-0.9806	2.0419	N
QC	Thetford Mines	Annual	1951 - 2010	48	3.8627	0.3069	-3.7743	11.4997	N
QC	Thetford Mines	Winter	1951 - 2010	57	-0.1478	0.9401	-4.1591	3.8635	N
QC	Thetford Mines	Spring	1951 - 2010	55	0.5040	0.7282	-2.4408	3.4488	N
QC	Thetford Mines	Summer	1951 - 2010	53	1.7938	0.3479	-2.0590	5.6466	N
QC	Thetford Mines	Autumn	1951 - 2010	56	0.6723	0.6878	-2.7241	4.0686	N
QC	Thetford Mines	Annual	1981 - 2010	26	3.6543	***0.0148***	0.7488	6.5598	N
QC	Thetford Mines	Winter	1981 - 2010	27	0.6345	0.3348	-0.6731	1.9421	N
QC	Thetford Mines	Spring	1981 - 2010	29	0.9845	0.1061	-0.2168	2.1858	N
QC	Thetford Mines	Summer	1981 - 2010	29	0.5887	0.3669	-0.7095	1.8868	N
QC	Thetford Mines	Autumn	1981 - 2010	29	1.0214	0.0745	-0.1046	2.1475	N
QC	Wright	Annual	1951 - 2010	52	1.3849	0.5925	-3.8846	6.6545	N
QC	Wright	Winter	1951 - 2010	57	-0.7543	0.4919	-2.9815	1.4729	N
QC	Wright	Spring	1951 - 2010	55	-1.3631	0.1990	-3.4891	0.7628	N
QC	Wright	Summer	1951 - 2010	57	2.2989	0.1218	-0.6555	5.2534	N
QC	Wright	Autumn	1951 - 2010	57	0.9334	0.5568	-2.2893	4.1560	N
QC	Wright	Annual	1981 - 2010	26	1.5044	0.1166	-0.3881	3.3970	N
QC	Wright	Winter	1981 - 2010	27	-0.4695	0.2879	-1.3463	0.4073	N
QC	Wright	Spring	1981 - 2010	28	0.6198	0.1148	-0.1556	1.3951	N
QC	Wright	Summer	1981 - 2010	28	0.1520	0.7706	-0.8873	1.1913	N
QC	Wright	Autumn	1981 - 2010	28	0.2698	0.6107	-0.7860	1.3255	N

Table A4: Parameter estimates for trends in total precipitation for stations in eastern Canada from 1900 - 2010. Slopes are given with lower and upper 95% confidence limits (LCL and UCL). Slopes and p-values are determined from linear models with a normal error distribution . Significant changes (p-values < 0.05) are denoted in bold and italics.

Province	Station Name	Season	Slope (mm/Year)	p-value	LCL	UCL
NB	Aroostook	Annual	1.1768	0.1249	-0.3342	2.6879
NB	Aroostook	Winter	0.6625	***0.0366***	0.0421	1.2829
NB	Aroostook	Spring	0.5050	0.0604	-0.0226	1.0325
NB	Aroostook	Summer	0.2859	0.4050	-0.3938	0.9657
NB	Aroostook	Autumn	0.0386	0.9120	-0.6538	0.7309
NB	Bathurst	Annual	3.7076	***<0.0001***	2.5131	4.9021
NB	Bathurst	Winter	0.9343	***0.0011***	0.3831	1.4854
NB	Bathurst	Spring	1.0077	***0.0001***	0.5093	1.5061
NB	Bathurst	Summer	0.4403	0.1097	-0.1011	0.9817
NB	Bathurst	Autumn	0.8636	***0.0056***	0.2596	1.4676
NB	Fredericton	Annual	1.2578	***0.0211***	0.1930	2.3226
NB	Fredericton	Winter	0.5311	***0.0330***	0.0438	1.0183
NB	Fredericton	Spring	0.5194	***0.0189***	0.0876	0.9511
NB	Fredericton	Summer	-0.0949	0.6977	-0.5782	0.3884
NB	Fredericton	Autumn	0.1096	0.6831	-0.4214	0.6407
NB	Moncton	Annual	4.1509	***<0.0001***	3.1621	5.1397
NB	Moncton	Winter	1.6201	***<0.0001***	1.0735	2.1668
NB	Moncton	Spring	1.4741	***<0.0001***	1.0382	1.9099
NB	Moncton	Summer	0.2229	0.3098	-0.2102	0.6560
NB	Moncton	Autumn	0.7909	***0.0029***	0.2768	1.3050
NB	Rexton	Annual	1.7930	***0.0382***	0.1001	3.4860
NB	Rexton	Winter	0.3542	0.3389	-0.3785	1.0869
NB	Rexton	Spring	0.7601	***0.0235***	0.1052	1.4150
NB	Rexton	Summer	0.5129	0.1317	-0.1571	1.1829
NB	Rexton	Autumn	0.7442	0.0521	-0.0070	1.4954
NB	Saint John	Annual	1.6958	***0.0178***	0.2988	3.0928
NB	Saint John	Winter	0.4498	0.1774	-0.2071	1.1067
NB	Saint John	Spring	0.3422	0.2231	-0.2115	0.8959
NB	Saint John	Summer	0.0365	0.9012	-0.5450	0.6179
NB	Saint John	Autumn	0.7212	***0.0198***	0.1167	1.3258
NL	Isle aux Morts	Annual	5.7066	***<0.0001***	4.0565	7.3566
NL	Isle aux Morts	Winter	2.7686	***<0.0001***	1.8982	3.6390
NL	Isle aux Morts	Spring	1.6245	***<0.0001***	0.8847	2.3642
NL	Isle aux Morts	Summer	0.3856	0.1817	-0.1840	0.9553
NL	Isle aux Morts	Autumn	0.9361	***0.0102***	0.2284	1.6438
NL	Plum Point	Annual	-1.5202	0.4028	-5.1664	2.1261
NL	Plum Point	Winter	-0.3767	0.7444	-2.7036	1.9502
NL	Plum Point	Spring	-1.6083	0.1335	-3.7345	0.5178
NL	Plum Point	Summer	0.0909	0.9243	-1.8350	2.0168
NL	Plum Point	Autumn	-0.0171	0.9844	-1.7801	1.7458
NL	St. Anthony	Annual	8.5388	***<0.0001***	6.5557	10.5220
NL	St. Anthony	Winter	2.8023	***<0.0001***	2.0205	3.5841
NL	St. Anthony	Spring	1.5346	***<0.0001***	0.8925	2.1766

Table A4 (continued)...

Province	Station Name	Season	Slope (mm/Year)	p-value	LCL	UCL
NL	St. Anthony	Summer	2.1122	***<0.0001***	1.3978	2.8265
NL	St. Anthony	Autumn	2.4999	***<0.0001***	1.7152	3.2846
NL	St. John's	Annual	1.9036	***0.0104***	0.4573	3.3498
NL	St. John's	Winter	0.5056	0.2084	-0.2866	1.2979
NL	St. John's	Spring	0.7721	***0.0184***	0.1328	1.4114
NL	St. John's	Summer	0.3518	0.1684	-0.1513	0.8549
NL	St. John's	Autumn	0.5805	0.0779	-0.0659	1.2268
NS	Collegeville	Annual	2.3808	***0.0114***	0.5554	4.2063
NS	Collegeville	Winter	0.1087	0.8114	-0.7952	1.0125
NS	Collegeville	Spring	0.5348	0.1815	-0.2552	1.3247
NS	Collegeville	Summer	0.3061	0.4203	-0.4457	1.0579
NS	Collegeville	Autumn	0.8784	***0.0364***	0.0572	1.6996
NS	Demming	Annual	3.3191	***<0.0001***	1.8401	4.7982
NS	Demming	Winter	0.4397	0.1756	-0.2002	1.0797
NS	Demming	Spring	1.3225	***<0.0001***	0.7458	1.8991
NS	Demming	Summer	0.7744	***0.0089***	0.1985	1.3504
NS	Demming	Autumn	0.9689	***0.0068***	0.2740	1.6639
NS	Halifax	Annual	0.2796	0.6426	-0.9116	1.4709
NS	Halifax	Winter	-0.0566	0.8229	-0.5565	0.4433
NS	Halifax	Spring	0.0588	0.8289	-0.4788	0.5963
NS	Halifax	Summer	0.0836	0.7872	-0.5290	0.6962
NS	Halifax	Autumn	-0.0122	0.9686	-0.6265	0.6020
NS	Sydney	Annual	3.0728	***<0.0001***	1.9115	4.2340
NS	Sydney	Winter	0.7708	***0.0299***	0.0766	1.4650
NS	Sydney	Spring	0.7749	***0.0064***	0.2221	1.3278
NS	Sydney	Summer	0.4671	0.0518	-0.0037	0.9379
NS	Sydney	Autumn	0.9722	***0.0022***	0.3590	1.5855
NS	Yarmouth	Annual	2.1515	***0.0002***	1.0342	3.2688
NS	Yarmouth	Winter	1.1078	***<0.0001***	0.6334	1.5823
NS	Yarmouth	Spring	0.2910	0.2838	-0.2445	0.8266
NS	Yarmouth	Summer	0.2247	0.3502	-0.2501	0.6996
NS	Yarmouth	Autumn	0.5850	***0.0445***	0.0147	1.1552
PE	Charlottetown	Annual	0.3008	0.5596	-0.7182	1.3197
PE	Charlottetown	Winter	0.3809	0.1721	-0.1684	0.9301
PE	Charlottetown	Spring	0.0223	0.9242	-0.4424	0.4871
PE	Charlottetown	Summer	0.2669	0.1818	-0.1268	0.6606
PE	Charlottetown	Autumn	-0.1968	0.4792	-0.7463	0.3527
QC	Bagotville	Annual	2.1480	***<0.0001***	1.2577	3.0383
QC	Bagotville	Winter	0.6644	***0.0027***	0.2359	1.0929
QC	Bagotville	Spring	0.7059	***0.0001***	0.3556	1.0561
QC	Bagotville	Summer	0.7976	***0.0002***	0.3919	1.2032
QC	Bagotville	Autumn	0.9244	***<0.0001***	0.5358	1.3130
QC	Gaspé	Annual	2.8984	***0.0027***	1.0407	4.7560
QC	Gaspé	Winter	0.3733	0.3424	-0.4044	1.1510
QC	Gaspé	Spring	0.5567	0.1758	-0.2544	1.3678
QC	Gaspé	Summer	0.4590	0.1143	-0.1131	1.0310
QC	Gaspé	Autumn	1.4495	***0.0004***	0.6740	2.2250

Table A4 (continued)...

Province	Station Name	Season	Slope (mm/Year)	p-value	LCL	UCL
QC	Lac Berry	Annual	0.4229	0.4763	-0.7546	1.6004
QC	Lac Berry	Winter	-0.5410	***0.0072***	-0.9318	-0.1501
QC	Lac Berry	Spring	0.0811	0.6758	-0.3031	0.4653
QC	Lac Berry	Summer	0.4403	0.1111	-0.1033	0.9839
QC	Lac Berry	Autumn	0.2166	0.3558	-0.2474	0.6806
QC	Montreal	Annual	0.4346	0.2898	-0.3751	1.2444
QC	Montreal	Winter	-0.2805	0.1427	-0.6570	0.0960
QC	Montreal	Spring	0.0592	0.7562	-0.3180	0.4365
QC	Montreal	Summer	0.3595	0.0533	-0.0052	0.7242
QC	Montreal	Autumn	0.2644	0.2048	-0.1464	0.6752
QC	Natashquan	Annual	2.3338	***0.0023***	0.8587	3.8089
QC	Natashquan	Winter	0.7982	***0.0163***	0.1510	1.4454
QC	Natashquan	Spring	0.5525	0.0653	-0.0359	1.1410
QC	Natashquan	Summer	0.3126	0.3170	-0.3049	0.9302
QC	Natashquan	Autumn	0.9323	***0.0131***	0.2010	1.6635
QC	Rimouski	Annual	0.8747	***0.0386***	0.0468	1.7026
QC	Rimouski	Winter	0.5169	***0.0068***	0.1459	0.8878
QC	Rimouski	Spring	0.0799	0.6616	-0.2812	0.4409
QC	Rimouski	Summer	-0.0421	0.8510	-0.4852	0.4010
QC	Rimouski	Autumn	0.2081	0.3100	-0.1964	0.6126
QC	Wright	Annual	2.0965	***0.0009***	0.8909	3.3020
QC	Wright	Winter	0.1891	0.4269	-0.2818	0.6600
QC	Wright	Spring	0.4742	***0.0415***	0.0187	0.9297
QC	Wright	Summer	1.0755	***0.0001***	0.5466	1.6044
QC	Wright	Autumn	0.6891	***0.0117***	0.1577	1.2205

Table A5: Parameter estimates for trends in annual mean discharge and ice-cover period for stations in eastern Canada for the past 30 and 60 years. Slopes are given with lower and upper 95% confidence limits (LCL and UCL). Slopes and p-values are determined from linear models with a normal error distribution or from a generalized linear model with a Gamma error distribution as indicated (N or G). Significant changes (p-values < 0.05) are denoted in bold and italics. Shaded p-values should be interpreted with caution as statistical assumptions were violated.

Province	Station Name	Test	Period	Slope (m^3/s/Year)	p-value	LCL	UCL	Normal or Gamma
NB	Coal Branch of Richibucto River	Annual Mean Discharge	1951 - 2010	0.0009	0.9136	-0.0164	0.0183	N
NB	Coal Branch of Richibucto River	Annual Mean Discharge	1981 - 2010	-0.0080	0.6570	-0.0443	0.0284	N
NB	Coal Branch of Richibucto River	Days with Ice	1951 - 2010	-0.4641	***0.0165***	-0.8393	-0.0889	N
NB	Coal Branch of Richibucto River	Days with Ice	1981 - 2010	-0.4078	0.2906	-1.1833	0.3677	N
NB	Kennebicasis(Apohaqui)	Annual Mean Discharge	1951 - 2010	0.0315	0.5550	-0.0751	0.1382	N
NB	Kennebicasis(Apohaqui)	Annual Mean Discharge	1981 - 2010	0.0236	0.8429	-0.2180	0.2652	N
NB	Kennebicasis(Apohaqui)	Days with Ice	1951 - 2010	-0.4629	***0.0099***	-0.8091	-0.1166	N
NB	Kennebicasis(Apohaqui)	Days with Ice	1981 - 2010	-0.4489	0.2500	-1.2317	0.3339	N
NB	LSW Miramichi(Lyttleton)	Annual Mean Discharge	1951 - 2010	0.0419	0.4778	-0.0755	0.1593	N
NB	LSW Miramichi(Lyttleton)	Annual Mean Discharge	1981 - 2010	0.2019	0.2481	-0.1487	0.5525	N
NB	LSW Miramichi(Lyttleton)	Days with Ice	1951 - 2010	-0.2249	***0.0472***	-0.4469	-0.0029	N
NB	LSW Miramichi(Lyttleton)	Days with Ice	1981 - 2010	-0.2209	0.3677	-0.7151	0.2733	N
NB	Pointe Wolfe	Annual Mean Discharge	1951 - 2010	-0.0108	0.3800	-0.0353	0.0137	N
NB	Pointe Wolfe	Annual Mean Discharge	1981 - 2010	0.0004	0.9850	-0.0470	0.0479	N
NB	Pointe Wolfe	Days with Ice	1951 - 2010	-0.6885	***0.0007***	-1.0699	-0.3071	N
NB	Pointe Wolfe	Days with Ice	1981 - 2010	-0.8586	***0.0095***	-1.5081	-0.2105	G
NB	Restigouche(Kedgwick River)	Annual Mean Discharge	1951 - 2010	0.1701	0.2256	-0.1087	0.4488	N
NB	Restigouche(Kedgwick River)	Annual Mean Discharge	1981 - 2010	0.3208	0.3038	-0.3064	0.9480	N
NB	Restigouche(Kedgwick River)	Days with Ice	1951 - 2010	-0.2864	***0.0338***	-0.5508	-0.0220	G
NB	Restigouche(Kedgwick River)	Days with Ice	1981 - 2010	-0.1640	0.5578	-0.7302	0.4023	N
NB	Saint John River (Grand Falls)	Annual Mean Discharge	1951 - 2010	0.6420	0.3530	-0.7306	2.0146	N
NB	Saint John River (Grand Falls)	Annual Mean Discharge	1981 - 2010	1.1633	0.5689	-2.9705	5.2972	N
NB	Saint John River (Grand Falls)	Days with Ice	1951 - 2010	-0.6518	0.0923	-1.4143	0.1108	N
NB	Saint John River (Grand Falls)	Days with Ice	1981 - 2010	-1.5259	0.1058	-3.3959	0.3441	N
NL	Alexis River(Port Hope Simpson)	Annual Mean Discharge	1951 - 2010	-0.0733	0.6071	-0.3615	0.2148	N
NL	Alexis River(Port Hope Simpson)	Annual Mean Discharge	1981 - 2010	-0.0778	0.6102	-0.3868	0.2312	N
NL	Alexis River(Port Hope Simpson)	Days with Ice	1951 - 2010	0.5975	***0.0179***	0.1104	1.0846	N
NL	Alexis River(Port Hope Simpson)	Days with Ice	1981 - 2010	0.6285	***0.0279***	0.0734	1.1836	N
NL	Bay du Nord(Big Falls)	Annual Mean Discharge	1951 - 2010	-0.0011	0.9825	-0.0985	0.0964	N

Table A5 (continued)…

Province	Station Name	Test	Period	Slope ($m^3/s/Year$)	p-value	LCL	UCL	Normal or Gamma
NL	Bay du Nord(Big Falls)	Annual Mean Discharge	1981 - 2010	-0.1384	0.3095	-0.4123	0.1355	N
NL	Bay du Nord(Big Falls)	Days with Ice	1951 - 2010	1.0603	***0.0001***	0.5429	1.5776	N
NL	Bay du Nord(Big Falls)	Days with Ice	1981 - 2010	0.3244	0.6303	-1.0411	1.6898	N
NL	Churchill River(Muskrat Falls)	Annual Mean Discharge	1951 - 2010	3.2031	0.1072	-0.7171	7.1232	N
NL	Churchill River(Muskrat Falls)	Annual Mean Discharge	1981 - 2010	-5.8737	0.1028	-13.0133	1.2660	N
NL	Churchill River(Muskrat Falls)	Days with Ice	1951 - 2010	-2.3457	***<0.0001***	-3.0985	-1.5930	N
NL	Churchill River(Muskrat Falls)	Days with Ice	1981 - 2010	0.0167	0.1748	-0.0079	0.0413	N
NL	Exploits River	Annual Mean Discharge	1951 - 2010	1.3894	***<0.0001***	0.8159	1.9629	N
NL	Exploits River	Annual Mean Discharge	1981 - 2010	2.5414	***0.0078***	0.6793	4.3790	G
NL	Exploits River	Days with Ice	1951 - 2010	0.0000	NA	0.0000	0.0000	N
NL	Exploits River	Days with Ice	1981 - 2010	0.0000	NA	0.0000	0.0000	N
NL	Gander River(Big Chute)	Annual Mean Discharge	1951 - 2010	0.2473	0.0913	-0.0410	0.5357	N
NL	Gander River(Big Chute)	Annual Mean Discharge	1981 - 2010	0.4817	0.2583	-0.3733	1.3367	N
NL	Gander River(Big Chute)	Days with Ice	1951 - 2010	0.3015	***0.0210***	0.0473	0.5557	N
NL	Gander River(Big Chute)	Days with Ice	1981 - 2010	-0.0209	0.9533	-0.7459	0.7041	N
NL	Harry's River	Annual Mean Discharge	1951 - 2010	-0.0234	0.6541	-0.1280	0.0813	N
NL	Harry's River	Annual Mean Discharge	1981 - 2010	-0.0454	0.6209	-0.2314	0.1406	N
NL	Harry's River	Days with Ice	1951 - 2010	0.3567	0.2481	-0.2584	0.9718	N
NL	Harry's River	Days with Ice	1981 - 2010	-0.0796	0.8717	-1.0805	0.9212	N
NL	Pipers Hole River	Annual Mean Discharge	1951 - 2010	0.0430	0.1916	-0.0222	0.1081	N
NL	Pipers Hole River	Annual Mean Discharge	1981 - 2010	0.0141	0.8806	-0.1760	0.2041	N
NL	Pipers Hole River	Days with Ice	1951 - 2010	0.4565	0.0790	-0.0548	0.9678	N
NL	Pipers Hole River	Days with Ice	1981 - 2010	0.7226	0.1946	-0.3912	1.8364	N
NL	Rocky River(Colinet)	Annual Mean Discharge	1951 - 2010	0.0035	0.7553	-0.0191	0.0261	N
NL	Rocky River(Colinet)	Annual Mean Discharge	1981 - 2010	-0.0053	0.8472	-0.0608	0.0502	N
NL	Rocky River(Colinet)	Days with Ice	1951 - 2010	0.3126	0.1798	-0.1487	0.7739	N
NL	Rocky River(Colinet)	Days with Ice	1981 - 2010	0.8667	0.1292	-0.2688	2.0023	N
NL	Torrent River	Annual Mean Discharge	1951 - 2010	-0.0836	***0.0086***	-0.1449	-0.0222	N
NL	Torrent River	Annual Mean Discharge	1981 - 2010	-0.0556	0.3203	-0.1680	0.0569	N
NL	Torrent River	Days with Ice	1951 - 2010	0.1773	0.5688	-0.4437	0.7983	N
NL	Torrent River	Days with Ice	1981 - 2010	-1.0165	0.1522	-2.4309	0.3980	N
NL	Ugjoktok River(Harp Lake)	Annual Mean Discharge	1951 - 2010	0.0915	0.8866	-1.2124	1.3954	N

Table A5 (continued)...

Province	Station Name	Test	Period	Slope (m^3/s/Year)	p-value	LCL	UCL	Normal or Gamma
NL	Ugjoktok River(Harp Lake)	Annual Mean Discharge	1981 - 2010	0.6042	0.3478	-0.6948	1.9031	N
NL	Ugjoktok River(Harp Lake)	Days with Ice	1951 - 2010	0.6743	***0.0106***	0.1572	1.1923	G
NL	Ugjoktok River(Harp Lake)	Days with Ice	1981 - 2010	0.5923	***0.0322***	0.0502	1.1354	G
NL	Upper Humber River	Annual Mean Discharge	1951 - 2010	0.0020	0.9805	-0.1620	0.1660	N
NL	Upper Humber River	Annual Mean Discharge	1981 - 2010	-0.1894	0.3986	-0.6419	0.2632	N
NL	Upper Humber River	Days with Ice	1951 - 2010	1.0812	***0.0001***	0.5788	1.5836	N
NL	Upper Humber River	Days with Ice	1981 - 2010	-0.2236	0.5904	-1.0646	0.6175	N
NS	Annapolis River(Wilmot)	Annual Mean Discharge	1951 - 2010	-0.0030	0.9076	-0.0543	0.0484	N
NS	Annapolis River(Wilmot)	Annual Mean Discharge	1981 - 2010	0.0537	0.2268	-0.0353	0.1427	N
NS	Annapolis River(Wilmot)	Days with Ice	1951 - 2010	0.6367	***0.0050***	0.1933	1.0791	G
NS	Annapolis River(Wilmot)	Days with Ice	1981 - 2010	-0.2877	0.4835	-1.1174	0.5421	N
NS	LeHave River	Annual Mean Discharge	1951 - 2010	-0.0348	0.4463	-0.1256	0.0560	N
NS	LeHave River	Annual Mean Discharge	1981 - 2010	0.0892	0.4646	-0.1572	0.3355	N
NS	LeHave River	Days with Ice	1951 - 2010	0.7590	***<0.0001***	0.5019	1.0162	N
NS	LeHave River	Days with Ice	1981 - 2010	0.3855	0.2742	-0.3226	1.0937	N
NS	NE Margaree River	Annual Mean Discharge	1951 - 2010	-0.0175	0.2828	-0.0498	0.0148	N
NS	NE Margaree River	Annual Mean Discharge	1981 - 2010	-0.1069	***0.0012***	-0.1675	-0.0464	N
NS	NE Margaree River	Days with Ice	1951 - 2010	1.4197	***<0.0001***	0.9715	1.8679	N
NS	NE Margaree River	Days with Ice	1981 - 2010	-0.3840	0.4348	-1.3766	0.6086	N
NS	Roseway River	Annual Mean Discharge	1951 - 2010	0.0136	0.5424	-0.0308	0.0581	N
NS	Roseway River	Annual Mean Discharge	1981 - 2010	0.0585	0.3500	-0.0676	0.1846	N
NS	Roseway River	Days with Ice	1951 - 2010	0.6421	***0.0002***	0.3251	0.9591	N
NS	Roseway River	Days with Ice	1981 - 2010	0.0278	0.9483	-0.8426	0.8982	N
NS	South River	Annual Mean Discharge	1951 - 2010	-0.0203	0.0514	-0.0408	0.0001	G
NS	South River	Annual Mean Discharge	1981 - 2010	-0.0197	0.2749	-0.0560	0.0166	N
NS	South River	Days with Ice	1951 - 2010	0.6959	***0.0049***	0.2226	1.1692	N
NS	South River	Days with Ice	1981 - 2010	0.0189	0.9685	-0.9546	0.9924	N
NS	St. Mary's River	Annual Mean Discharge	1951 - 2010	-0.0743	0.1636	-0.1796	0.0311	N
NS	St. Mary's River	Annual Mean Discharge	1981 - 2010	-0.2057	0.1612	-0.4986	0.0871	N
NS	St. Mary's River	Days with Ice	1951 - 2010	0.9479	***<0.0001***	0.6358	1.2600	N
NS	St. Mary's River	Days with Ice	1981 - 2010	0.4908	0.2174	-0.3059	1.2874	N
PE	Carruthers Brook	Annual Mean Discharge	1951 - 2010	0.0000	0.9896	-0.0038	0.0039	N

Table A5 (continued)...

Province	Station Name	Test	Period	Slope (m^3/s/Year)	p-value	LCL	UCL	Normal or Gamma
PE	Carruthers Brook	Annual Mean Discharge	1981 - 2010	0.0048	0.2216	-0.0031	0.0128	N
PE	Carruthers Brook	Days with Ice	1951 - 2010	0.1300	0.5871	-0.3483	0.6083	N
PE	Carruthers Brook	Days with Ice	1981 - 2010	-1.2446	***0.0233***	-2.3184	-0.1712	G
PE	Wilmot River	Annual Mean Discharge	1951 - 2010	0.0003	0.9136	-0.0052	0.0058	N
PE	Wilmot River	Annual Mean Discharge	1981 - 2010	0.0013	0.7165	-0.0062	0.0088	N
PE	Wilmot River	Days with Ice	1951 - 2010	-0.1791	0.5973	-0.8607	0.5024	N
PE	Wilmot River	Days with Ice	1981 - 2010	0.2883	0.5602	-0.7133	1.2899	N
QC	A la Baleine	Annual Mean Discharge	1951 - 2010	-2.1570	***0.0183***	-3.9271	-0.3870	N
QC	A la Baleine	Annual Mean Discharge	1981 - 2010	-0.3785	0.8175	-3.7636	3.0067	N
QC	A la Baleine	Days with Ice	1951 - 2010	0.0703	0.7312	-0.3415	0.4822	N
QC	A la Baleine	Days with Ice	1981 - 2010	0.7563	***0.0445***	0.0183	1.5215	G
QC	Aux Mélèzes	Annual Mean Discharge	1951 - 2010	-3.8352	***0.0101***	-6.6767	-0.9937	N
QC	Aux Mélèzes	Annual Mean Discharge	1981 - 2010	-6.3664	0.3304	-20.3636	7.6309	N
QC	Aux Mélèzes	Days with Ice	1951 - 2010	-0.1347	0.8673	-1.7692	1.4997	N
QC	Aux Mélèzes	Days with Ice	1981 - 2010	4.5495	0.1510	-1.9133	11.0123	N
QC	Bell	Annual Mean Discharge	1951 - 2010	-1.0769	***0.0936***	-2.3437	0.1899	N
QC	Bell	Annual Mean Discharge	1981 - 2010	-0.0453	0.9676	-2.3287	2.2380	N
QC	Bell	Days with Ice	1951 - 2010	1.7554	***0.0102***	0.4388	3.0721	N
QC	Bell	Days with Ice	1981 - 2010	5.4583	***<0.0001***	4.0709	6.8456	N
QC	Chaudière	Annual Mean Discharge	1951 - 2010	0.0915	0.5967	-0.2525	0.4354	N
QC	Chaudière	Annual Mean Discharge	1981 - 2010	0.5942	0.1906	-0.3126	1.5010	N
QC	Chaudière	Days with Ice	1951 - 2010	-1.1333	***0.0001***	-1.6742	-0.5925	N
QC	Chaudière	Days with Ice	1981 - 2010	-1.9991	***0.0112***	-3.5087	-0.4895	N
QC	Chicoutimi	Annual Mean Discharge	1951 - 2010	0.0812	0.1840	-0.0397	0.2022	N
QC	Chicoutimi	Annual Mean Discharge	1981 - 2010	0.1006	0.6007	-0.2886	0.4897	N
QC	Chicoutimi	Days with Ice	1951 - 2010	0.0000	NA	0.0000	0.0000	N
QC	Chicoutimi	Days with Ice	1981 - 2010	0.0000	NA	0.0000	0.0000	N
QC	Des Prairies	Annual Mean Discharge	1951 - 2010	-0.0493	0.9648	-2.2781	2.1795	N
QC	Des Prairies	Annual Mean Discharge	1981 - 2010	-4.4073	0.2211	-11.6656	2.8510	N
QC	Des Prairies	Days with Ice	1951 - 2010	-0.5846	0.2355	-1.5620	0.3928	N
QC	Des Prairies	Days with Ice	1981 - 2010	-0.7774	0.4670	-2.9345	1.3796	N
QC	Eaton	Annual Mean Discharge	1951 - 2010	0.0132	0.5556	-0.0315	0.0580	N

Table A5 (continued)...

Province	Station Name	Test	Period	Slope (m^3/s/Year)	p-value	LCL	UCL	Normal or Gamma
QC	Eaton	Annual Mean Discharge	1981 - 2010	0.0973	0.0942	-0.0177	0.2123	N
QC	Eaton	Days with Ice	1951 - 2010	-0.7436	***0.0070***	-1.2746	-0.2126	N
QC	Eaton	Days with Ice	1981 - 2010	-1.8218	***0.0104***	-3.1835	-0.4601	N
QC	Grand rivière de la Baleine	Annual Mean Discharge	1951 - 2010	-2.3175	***0.0013***	-3.6629	-0.9721	N
QC	Grand rivière de la Baleine	Annual Mean Discharge	1981 - 2010	-1.3163	0.3054	-3.9176	1.2850	N
QC	Grand rivière de la Baleine	Days with Ice	1951 - 2010	-0.0522	0.9504	-1.7379	1.6336	N
QC	Grand rivière de la Baleine	Days with Ice	1981 - 2010	3.8691	***0.0281***	0.4528	7.2854	N
QC	Harricana	Annual Mean Discharge	1951 - 2010	-0.0305	0.6927	-0.1844	0.1234	N
QC	Harricana	Annual Mean Discharge	1981 - 2010	0.1365	0.5132	-0.2862	0.5592	N
QC	Harricana	Days with Ice	1951 - 2010	2.0387	***<0.0001***	1.2457	2.8317	N
QC	Harricana	Days with Ice	1981 - 2010	2.9881	***0.0070***	0.8846	5.0915	N
QC	Kinojévis	Annual Mean Discharge	1951 - 2010	0.0023	0.9790	-0.1754	0.1801	N
QC	Kinojévis	Annual Mean Discharge	1981 - 2010	0.0095	0.9434	-0.2633	0.2824	N
QC	Kinojévis	Days with Ice	1951 - 2010	0.4427	0.2674	-0.3532	1.2385	N
QC	Kinojévis	Days with Ice	1981 - 2010	1.5952	***0.0115***	0.3861	2.8042	N
QC	Lac des Loups Marins	Annual Mean Discharge	1951 - 2010	-0.4493	0.3110	-1.3423	0.4437	N
QC	Lac des Loups Marins	Annual Mean Discharge	1981 - 2010	-0.6222	0.1996	-1.5980	0.3535	N
QC	Lac des Loups Marins	Days with Ice	1951 - 2010	2.2142	0.1154	-0.5774	5.0058	N
QC	Lac des Loups Marins	Days with Ice	1981 - 2010	5.0236	***0.0020***	2.0501	7.9971	N
QC	Matane	Annual Mean Discharge	1951 - 2010	-0.0296	0.5250	-0.1220	0.0629	N
QC	Matane	Annual Mean Discharge	1981 - 2010	-0.0410	0.7786	-0.3365	0.2545	N
QC	Matane	Days with Ice	1951 - 2010	-0.7391	***0.0096***	-1.2911	-0.1871	N
QC	Matane	Days with Ice	1981 - 2010	-1.3431	0.1002	-2.9601	0.2739	N
QC	Mattawin	Annual Mean Discharge	1951 - 2010	0.0190	0.5886	-0.0508	0.0887	N
QC	Mattawin	Annual Mean Discharge	1981 - 2010	0.0542	0.6162	-0.1646	0.2730	N
QC	Mattawin	Days with Ice	1951 - 2010	-0.2968	0.1634	-0.7180	0.1244	N
QC	Mattawin	Days with Ice	1981 - 2010	-0.2746	0.6125	-1.3700	0.8209	N
QC	Moisie	Annual Mean Discharge	1951 - 2010	-2.3956	***0.0013***	-3.7881	-1.0031	N
QC	Moisie	Annual Mean Discharge	1981 - 2010	-0.4127	0.7217	-2.7680	1.9427	N
QC	Moisie	Days with Ice	1951 - 2010	0.0722	0.7604	-0.4029	0.5473	N
QC	Moisie	Days with Ice	1981 - 2010	-0.9098	***0.0124***	-1.6196	-0.1976	G
QC	Nicolet	Annual Mean Discharge	1951 - 2010	0.0026	0.9734	-0.1523	0.1575	N

Table A5 (continued)...

Province	Station Name	Test	Period	Slope (m^3/s/Year)	p-value	LCL	UCL	Normal or Gamma
QC	Nicolet	Annual Mean Discharge	1981 - 2010	0.0700	0.5667	-0.1772	0.3173	N
QC	Nicolet	Days with Ice	1951 - 2010	-0.7864	***0.0396***	-1.5337	-0.0391	N
QC	Nicolet	Days with Ice	1981 - 2010	-1.6411	***0.0164***	-2.9581	-0.3242	N
QC	Romaine	Annual Mean Discharge	1951 - 2010	-0.8181	***0.0230***	-1.5218	-0.1133	G
QC	Romaine	Annual Mean Discharge	1981 - 2010	-0.3448	0.7036	-2.1822	1.4926	N
QC	Romaine	Days with Ice	1951 - 2010	0.8523	***0.0163***	0.1638	1.5407	N
QC	Romaine	Days with Ice	1981 - 2010	0.0321	0.9252	-0.6625	0.7267	N
QC	Saint-Louis	Annual Mean Discharge	1951 - 2010	0.0013	0.6760	-0.0050	0.0077	N
QC	Saint-Louis	Annual Mean Discharge	1981 - 2010	0.0083	0.1125	-0.0021	0.0187	N
QC	Saint-Louis	Days with Ice	1951 - 2010	0.7290	0.1894	-0.3758	1.8339	N
QC	Saint-Louis	Days with Ice	1981 - 2010	1.5500	0.0828	-0.2161	3.3160	N

Table A6: Parameter estimates for trends in timing and magnitude of seasonal extreme flows for stations in eastern Canada for the past 30 and 60 years. Slopes are given with lower and upper 95% confidence limits (LCL and UCL). Slopes and p-values are determined from linear models with a normal error distribution or from a generalized linear model with a Gamma error distribution as indicated (N or G). Significant changes (p-values < 0.05) are denoted in bold and italics. Shaded p-values should be interpreted with caution as statistical assumptions were violated.

Province	Station Name	Test	Period	Slope	p-value	LCL	UCL	Normal or Gamma
NB	Coal Branch of Richibucto River	Timing of Spring Maximum	1951 - 2010	-0.1598	0.1763	-0.3877	0.0681	N
NB	Coal Branch of Richibucto River	Timing of Spring Maximum	1981 - 2010	-0.1227	0.5988	-0.6909	0.3939	N
NB	Coal Branch of Richibucto River	Timing of Summer Minimum	1951 - 2010	-0.0912	0.7179	-0.5825	0.4002	N
NB	Coal Branch of Richibucto River	Timing of Summer Minimum	1981 - 2010	0.3842	0.4320	-0.1840	0.3939	N
NB	Coal Branch of Richibucto River	Timing of Winter Minimum	1951 - 2010	-0.1743	0.5507	-0.7426	0.3939	N
NB	Coal Branch of Richibucto River	Timing of Winter Minimum	1981 - 2010	0.3108	0.6095	-0.2574	0.3939	N
NB	Kennebicasis (Apohaqui)	Timing of Spring Maximum	1951 - 2010	0.1151	0.5978	-0.3096	0.5398	N
NB	Kennebicasis (Apohaqui)	Timing of Spring Maximum	1981 - 2010	0.1754	0.6546	-0.4075	0.1798	N
NB	Kennebicasis (Apohaqui)	Timing of Summer Minimum	1951 - 2010	-0.0462	0.8539	-0.5355	0.4430	N
NB	Kennebicasis (Apohaqui)	Timing of Summer Minimum	1981 - 2010	-0.3527	0.5242	-0.9356	0.1798	N
NB	Kennebicasis (Apohaqui)	Timing of Winter Minimum	1951 - 2010	-0.4031	0.1818	-0.9859	0.1798	N
NB	Kennebicasis (Apohaqui)	Timing of Winter Minimum	1981 - 2010	0.0985	0.8871	-0.4843	0.1798	N
NB	LSW Miramichi (Lyttleton)	Timing of Spring Maximum	1951 - 2010	-0.3532	***<0.0001***	-0.4945	-0.2119	N
NB	LSW Miramichi (Lyttleton)	Timing of Spring Maximum	1981 - 2010	-0.2739	0.1637	-0.6761	0.4100	N
NB	LSW Miramichi (Lyttleton)	Timing of Summer Minimum	1951 - 2010	0.2072	0.2401	-0.1350	0.5494	N
NB	LSW Miramichi (Lyttleton)	Timing of Summer Minimum	1981 - 2010	0.7941	0.0963	0.3919	0.4100	N
NB	LSW Miramichi (Lyttleton)	Timing of Winter Minimum	1951 - 2010	0.0078	0.9699	-0.3944	0.4100	N
NB	LSW Miramichi (Lyttleton)	Timing of Winter Minimum	1981 - 2010	0.2793	0.6082	-0.1229	0.4100	N
NB	Pointe Wolfe	Timing of Spring Maximum	1951 - 2010	-0.3547	***0.0178***	-0.6563	-0.0530	G
NB	Pointe Wolfe	Timing of Spring Maximum	1981 - 2010	0.1034	0.7188	-0.4743	0.3089	N
NB	Pointe Wolfe	Timing of Summer Minimum	1951 - 2010	0.3368	0.2644	-0.2473	0.9210	N
NB	Pointe Wolfe	Timing of Summer Minimum	1981 - 2010	0.6256	0.3288	0.0479	0.3089	N
NB	Pointe Wolfe	Timing of Winter Minimum	1951 - 2010	-0.2688	0.3668	-0.8466	0.3089	N
NB	Pointe Wolfe	Timing of Winter Minimum	1981 - 2010	-0.3532	0.5561	-0.9310	0.3089	N
NB	Restigouche(Kedgewick River)	Timing of Spring Maximum	1951 - 2010	-0.3013	***0.0001***	-0.4353	-0.1672	N
NB	Restigouche(Kedgewick River)	Timing of Spring Maximum	1981 - 2010	-0.0670	0.6686	-0.6371	0.4972	N
NB	Restigouche(Kedgewick River)	Timing of Summer Minimum	1951 - 2010	0.2254	0.3359	-0.2289	0.6796	N
NB	Restigouche(Kedgewick River)	Timing of Summer Minimum	1981 - 2010	0.2172	0.6492	-0.3529	0.4972	N
NB	Restigouche(Kedgewick River)	Timing of Winter Minimum	1951 - 2010	-0.0729	0.8031	-0.6431	0.4972	N
NB	Restigouche(Kedgewick River)	Timing of Winter Minimum	1981 - 2010	0.2759	0.6520	-0.2943	0.4972	N

Table A6 (continued)...

Province	Station Name	Test	Period	Slope	p-value	LCL	UCL	Normal or Gamma
NB	Saint John River (GrandFalls)	Timing of Spring Maximum	1951 - 2010	-0.1637	***0.0081***	-0.2808	-0.0466	N
NB	Saint John River (GrandFalls)	Timing of Spring Maximum	1981 - 2010	-0.1453	0.4146	-0.5948	0.6952	N
NB	Saint John River (GrandFalls)	Timing of Summer Minimum	1951 - 2010	0.1963	0.2733	-0.1516	0.5442	N
NB	Saint John River (GrandFalls)	Timing of Summer Minimum	1981 - 2010	0.4995	0.3545	0.0500	0.6952	N
NB	Saint John River (GrandFalls)	Timing of Winter Minimum	1951 - 2010	0.2457	0.2884	-0.2038	0.6952	N
NB	Saint John River (GrandFalls)	Timing of Winter Minimum	1981 - 2010	0.2286	0.7111	-0.2209	0.6952	N
NL	Alexis River (Port Hope Simpson)	Timing of Spring Maximum	1951 - 2010	-0.0127	0.9347	-0.3141	0.2887	N
NL	Alexis River (Port Hope Simpson)	Timing of Spring Maximum	1981 - 2010	-0.0704	0.7185	-0.9897	0.9607	N
NL	Alexis River (Port Hope Simpson)	Timing of Summer Minimum	1951 - 2010	-0.0866	0.8530	-0.9944	0.8213	N
NL	Alexis River (Port Hope Simpson)	Timing of Summer Minimum	1981 - 2010	-0.2325	0.6906	-1.1517	0.9607	N
NL	Alexis River (Port Hope Simpson)	Timing of Winter Minimum	1951 - 2010	0.0414	0.9302	-0.8778	0.9607	N
NL	Alexis River (Port Hope Simpson)	Timing of Winter Minimum	1981 - 2010	-0.5414	0.1807	-1.4606	0.9607	N
NL	Bay du Nord River (Big Falls)	Timing of Spring Maximum	1951 - 2010	0.0720	0.7594	-0.3864	0.5304	N
NL	Bay du Nord River (Big Falls)	Timing of Spring Maximum	1981 - 2010	0.1749	0.7974	-0.3981	0.2635	N
NL	Bay du Nord River (Big Falls)	Timing of Summer Minimum	1951 - 2010	-0.0097	0.9558	-0.3513	0.3319	N
NL	Bay du Nord River (Big Falls)	Timing of Summer Minimum	1981 - 2010	-0.5990	0.2242	-1.1720	0.2635	N
NL	Bay du Nord River (Big Falls)	Timing of Winter Minimum	1951 - 2010	-0.3095	0.2943	-0.8826	0.2635	N
NL	Bay du Nord River (Big Falls)	Timing of Winter Minimum	1981 - 2010	1.4074	0.0912	0.8344	0.2635	N
NL	Churchill River(Muskrat Falls)	Timing of Spring Maximum	1951 - 2010	-0.5600	***<0.0001***	-0.7201	-0.3999	N
NL	Churchill River(Muskrat Falls)	Timing of Spring Maximum	1981 - 2010	-0.0709	0.7136	-0.7381	0.8116	N
NL	Churchill River(Muskrat Falls)	Timing of Summer Minimum	1951 - 2010	-0.2814	0.0789	-0.5977	0.0348	G
NL	Churchill River(Muskrat Falls)	Timing of Summer Minimum	1981 - 2010	0.0841	0.8663	-0.5831	0.8116	N
NL	Churchill River(Muskrat Falls)	Timing of Winter Minimum	1951 - 2010	0.1443	0.6733	-0.5229	0.8116	N
NL	Churchill River(Muskrat Falls)	Timing of Winter Minimum	1981 - 2010	0.7983	0.4586	0.1310	0.8116	N
NL	Exploits River	Timing of Spring Maximum	1951 - 2010	-0.1690	0.2493	-0.4536	0.1157	N
NL	Exploits River	Timing of Spring Maximum	1981 - 2010	-0.1926	0.6403	-0.8083	0.7696	N
NL	Exploits River	Timing of Summer Minimum	1951 - 2010	0.1616	0.4203	-0.2286	0.5518	N
NL	Exploits River	Timing of Summer Minimum	1981 - 2010	0.1141	0.8354	-0.5016	0.7696	N
NL	Exploits River	Timing of Winter Minimum	1951 - 2010	0.1539	0.6261	-0.4618	0.7696	N
NL	Exploits River	Timing of Winter Minimum	1981 - 2010	0.3813	0.6935	-0.2344	0.7696	N
NL	Gander River(Big Chute)	Timing of Spring Maximum	1951 - 2010	-0.0852	0.5289	-0.3488	0.1784	N
NL	Gander River(Big Chute)	Timing of Spring Maximum	1981 - 2010	-0.0700	0.8471	-0.5996	0.7561	N
NL	Gander River(Big Chute)	Timing of Summer Minimum	1951 - 2010	-0.1592	0.3205	-0.4708	0.1523	N

Table A6 (continued)...

Province	Station Name	Test	Period	Slope	p-value	LCL	UCL	Normal or Gamma
NL	Gander River(Big Chute)	Timing of Summer Minimum	1981 - 2010	-0.4852	0.3227	-1.0149	0.7561	N
NL	Gander River(Big Chute)	Timing of Winter Minimum	1951 - 2010	0.2264	0.4056	-0.3033	0.7561	N
NL	Gander River(Big Chute)	Timing of Winter Minimum	1981 - 2010	1.5419	0.0538	1.0122	0.7561	N
NL	Harry's River	Timing of Spring Maximum	1951 - 2010	-0.2262	0.3185	-0.6652	0.2127	N
NL	Harry's River	Timing of Spring Maximum	1981 - 2010	-0.1236	0.7565	-0.9009	0.7122	N
NL	Harry's River	Timing of Summer Minimum	1951 - 2010	0.2640	0.3909	-0.3327	0.8606	N
NL	Harry's River	Timing of Summer Minimum	1981 - 2010	0.0970	0.8668	-0.6802	0.7122	N
NL	Harry's River	Timing of Winter Minimum	1951 - 2010	-0.0651	0.8705	-0.8423	0.7122	N
NL	Harry's River	Timing of Winter Minimum	1981 - 2010	0.3956	0.5280	-0.3817	0.7122	N
NL	Pipers Hole River	Timing of Spring Maximum	1951 - 2010	-0.0698	0.7424	-0.4837	0.3442	N
NL	Pipers Hole River	Timing of Spring Maximum	1981 - 2010	0.3842	0.4880	-0.1480	0.6142	N
NL	Pipers Hole River	Timing of Summer Minimum	1951 - 2010	0.0092	0.9595	-0.3432	0.3615	N
NL	Pipers Hole River	Timing of Summer Minimum	1981 - 2010	-0.4502	0.3603	-0.9825	0.6142	N
NL	Pipers Hole River	Timing of Winter Minimum	1951 - 2010	0.0819	0.7640	-0.4503	0.6142	N
NL	Pipers Hole River	Timing of Winter Minimum	1981 - 2010	0.9906	0.1837	0.4584	0.6142	N
NL	Rocky River(Colinet)	Timing of Spring Maximum	1951 - 2010	0.2619	0.2031	-0.1370	0.6607	N
NL	Rocky River(Colinet)	Timing of Spring Maximum	1981 - 2010	-0.4547	0.4405	-0.9498	0.6301	N
NL	Rocky River(Colinet)	Timing of Summer Minimum	1951 - 2010	-0.0821	0.6659	-0.4527	0.2886	N
NL	Rocky River(Colinet)	Timing of Summer Minimum	1981 - 2010	0.3695	0.5004	-0.1257	0.6301	N
NL	Rocky River(Colinet)	Timing of Winter Minimum	1951 - 2010	0.1349	0.5953	-0.3602	0.6301	N
NL	Rocky River(Colinet)	Timing of Winter Minimum	1981 - 2010	0.7108	0.3248	0.2157	0.6301	N
NL	Torrent River	Timing of Spring Maximum	1951 - 2010	-0.2542	***0.0087***	-0.4365	-0.0720	N
NL	Torrent River	Timing of Spring Maximum	1981 - 2010	-0.1163	0.6193	-0.5927	0.2127	N
NL	Torrent River	Timing of Summer Minimum	1951 - 2010	-0.1143	0.5630	-0.4990	0.2704	N
NL	Torrent River	Timing of Summer Minimum	1981 - 2010	0.0576	0.9008	-0.4188	0.2127	N
NL	Torrent River	Timing of Winter Minimum	1951 - 2010	-0.2637	0.2833	-0.7402	0.2127	N
NL	Torrent River	Timing of Winter Minimum	1981 - 2010	-0.6606	0.2305	-1.1371	0.2127	N
NL	Ugjoktok River(Harp Lake)	Timing of Spring Maximum	1951 - 2010	0.0332	0.8731	-0.3704	0.4367	N
NL	Ugjoktok River(Harp Lake)	Timing of Spring Maximum	1981 - 2010	0.0197	0.9332	-0.5459	0.2333	N
NL	Ugjoktok River(Harp Lake)	Timing of Summer Minimum	1951 - 2010	0.5096	***0.0430***	0.0142	1.0051	G
NL	Ugjoktok River(Harp Lake)	Timing of Summer Minimum	1981 - 2010	0.6186	***0.0280***	0.0545	0.2254	G
NL	Ugjoktok River(Harp Lake)	Timing of Winter Minimum	1951 - 2010	-0.3323	0.2592	-0.8980	0.2333	N
NL	Ugjoktok River(Harp Lake)	Timing of Winter Minimum	1981 - 2010	-0.4759	0.1617	-1.0415	0.2333	N

Table A6 (continued)...

Province	Station Name	Test	Period	Slope	p-value	LCL	UCL	Normal or Gamma
NL	Upper Humber River	Timing of Spring Maximum	1951 - 2010	-0.1394	0.0998	-0.3026	0.0239	N
NL	Upper Humber River	Timing of Spring Maximum	1981 - 2010	-0.1197	0.5906	-0.4957	0.0470	N
NL	Upper Humber River	Timing of Summer Minimum	1951 - 2010	-0.3098	***0.0460***	-0.6133	-0.0063	G
NL	Upper Humber River	Timing of Summer Minimum	1981 - 2010	-0.1892	0.6687	-0.5652	0.0470	N
NL	Upper Humber River	Timing of Winter Minimum	1951 - 2010	-0.3290	0.0919	-0.7050	0.0470	N
NL	Upper Humber River	Timing of Winter Minimum	1981 - 2010	0.4108	0.4951	0.0348	0.0470	N
NS	Annapolis River(Wilmot)	Timing of Spring Maximum	1951 - 2010	-0.0169	0.9367	-0.4312	0.3975	N
NS	Annapolis River(Wilmot)	Timing of Spring Maximum	1981 - 2010	-0.1611	0.6699	-1.0545	1.3137	N
NS	Annapolis River(Wilmot)	Timing of Summer Minimum	1951 - 2010	-0.3163	0.1339	-0.7223	0.0898	N
NS	Annapolis River(Wilmot)	Timing of Summer Minimum	1981 - 2010	-0.3744	0.4005	-1.2678	1.3137	N
NS	Annapolis River(Wilmot)	Timing of Winter Minimum	1951 - 2010	0.4203	0.3614	-0.4731	1.3137	N
NS	Annapolis River(Wilmot)	Timing of Winter Minimum	1981 - 2010	0.4798	0.5935	-0.4136	1.3137	N
NS	LeHave River	Timing of Spring Maximum	1951 - 2010	0.0855	0.6447	-0.2759	0.4468	N
NS	LeHave River	Timing of Spring Maximum	1981 - 2010	-0.5123	0.3061	-1.1107	0.4159	N
NS	LeHave River	Timing of Summer Minimum	1951 - 2010	0.1619	0.4036	-0.2154	0.5392	N
NS	LeHave River	Timing of Summer Minimum	1981 - 2010	-0.8985	0.1403	-1.4969	0.4159	N
NS	LeHave River	Timing of Winter Minimum	1951 - 2010	-0.1825	0.5524	-0.7809	0.4159	N
NS	LeHave River	Timing of Winter Minimum	1981 - 2010	0.7315	0.4182	0.1331	0.4159	N
NS	NE Margaree River	Timing of Spring Maximum	1951 - 2010	-0.2915	0.1023	-0.6357	0.0528	N
NS	NE Margaree River	Timing of Spring Maximum	1981 - 2010	0.4236	0.3475	-0.0259	0.2771	N
NS	NE Margaree River	Timing of Summer Minimum	1951 - 2010	-0.2190	0.1744	-0.5312	0.0933	N
NS	NE Margaree River	Timing of Summer Minimum	1981 - 2010	0.1419	0.7889	-0.3076	0.2771	N
NS	NE Margaree River	Timing of Winter Minimum	1951 - 2010	-0.1724	0.4553	-0.6219	0.2771	N
NS	NE Margaree River	Timing of Winter Minimum	1981 - 2010	-0.0640	0.9063	-0.5135	0.2771	N
NS	Roseway River	Timing of Spring Maximum	1951 - 2010	0.3399	0.0988	-0.0573	0.7371	N
NS	Roseway River	Timing of Spring Maximum	1981 - 2010	0.6882	0.1882	0.0719	0.5061	N
NS	Roseway River	Timing of Summer Minimum	1951 - 2010	0.1319	0.5301	-0.2775	0.5413	N
NS	Roseway River	Timing of Summer Minimum	1981 - 2010	0.4113	0.5549	-0.2049	0.5061	N
NS	Roseway River	Timing of Winter Minimum	1951 - 2010	-0.1101	0.7274	-0.7264	0.5061	N
NS	Roseway River	Timing of Winter Minimum	1981 - 2010	0.6498	0.4792	0.0335	0.5061	N
NS	South River	Timing of Spring Maximum	1951 - 2010	-0.0973	0.7189	-0.6238	0.4291	N
NS	South River	Timing of Spring Maximum	1981 - 2010	0.1680	0.7424	-0.5470	0.5084	N
NS	South River	Timing of Summer Minimum	1951 - 2010	-0.2705	0.4129	-0.9115	0.3706	N

Table A6 (continued)...

Province	Station Name	Test	Period	Slope	p-value	LCL	UCL	Normal or Gamma
NS	South River	Timing of Summer Minimum	1981 - 2010	-1.3585	0.0655	-2.0038	0.3503	G
NS	South River	Timing of Winter Minimum	1951 - 2010	-0.2066	0.5741	-0.9216	0.5084	N
NS	South River	Timing of Winter Minimum	1981 - 2010	0.4690	0.5255	-0.2460	0.5084	N
NS	St. Mary's River	Timing of Spring Maximum	1951 - 2010	0.1082	0.5559	-0.2499	0.4664	N
NS	St. Mary's River	Timing of Spring Maximum	1981 - 2010	-0.2197	0.6204	-0.6581	0.3536	N
NS	St. Mary's River	Timing of Summer Minimum	1951 - 2010	-0.1634	0.3465	-0.5009	0.1741	N
NS	St. Mary's River	Timing of Summer Minimum	1981 - 2010	-0.0655	0.9144	-0.5039	0.3536	N
NS	St. Mary's River	Timing of Winter Minimum	1951 - 2010	-0.0848	0.7060	-0.5232	0.3536	N
NS	St. Mary's River	Timing of Winter Minimum	1981 - 2010	-0.5488	0.3539	-0.9871	0.3536	N
PE	Carruthers Brook	Timing of Spring Maximum	1951 - 2010	-0.2439	***0.0411***	-0.4714	-0.0163	N
PE	Carruthers Brook	Timing of Spring Maximum	1981 - 2010	-0.1507	0.4622	-0.7806	0.6713	N
PE	Carruthers Brook	Timing of Summer Minimum	1951 - 2010	-0.0398	0.8267	-0.3940	0.3144	N
PE	Carruthers Brook	Timing of Summer Minimum	1981 - 2010	-0.3783	0.2909	-1.0082	0.6713	N
PE	Carruthers Brook	Timing of Winter Minimum	1951 - 2010	0.0414	0.8980	-0.5885	0.6713	N
PE	Carruthers Brook	Timing of Winter Minimum	1981 - 2010	0.3897	0.5388	-0.2402	0.6713	N
PE	Wilmot River	Timing of Spring Maximum	1951 - 2010	0.0897	0.7503	-0.4585	0.6379	N
PE	Wilmot River	Timing of Spring Maximum	1981 - 2010	-0.0286	0.9382	-1.2838	1.6608	N
PE	Wilmot River	Timing of Summer Minimum	1951 - 2010	-0.2893	0.2950	-0.8230	0.2445	N
PE	Wilmot River	Timing of Summer Minimum	1981 - 2010	-0.6340	0.1052	-1.8892	1.6608	N
PE	Wilmot River	Timing of Winter Minimum	1951 - 2010	0.4055	0.5306	-0.8497	1.6608	N
PE	Wilmot River	Timing of Winter Minimum	1981 - 2010	0.4291	0.6458	-0.8262	1.6608	N
QC	A la Baleine	Timing of Spring Maximum	1951 - 2010	-0.0376	0.7443	-0.2620	0.1867	N
QC	A la Baleine	Timing of Spring Maximum	1981 - 2010	0.5430	***0.0368***	0.2258	0.2524	G
QC	A la Baleine	Timing of Summer Minimum	1951 - 2010	0.0666	0.7745	-0.3858	0.5190	N
QC	A la Baleine	Timing of Summer Minimum	1981 - 2010	0.7816	0.1384	0.4635	0.2535	N
QC	A la Baleine	Timing of Winter Minimum	1951 - 2010	-0.0645	0.6933	-0.3825	0.2535	N
QC	A la Baleine	Timing of Winter Minimum	1981 - 2010	0.2911	0.4642	-0.0269	0.2535	N
QC	Aux Mélèzes	Timing of Spring Maximum	1951 - 2010	-0.3531	***0.0088***	-0.6169	-0.0892	G
QC	Aux Mélèzes	Timing of Spring Maximum	1981 - 2010	-0.1181	0.8570	-0.4689	0.1119	N
QC	Aux Mélèzes	Timing of Summer Minimum	1951 - 2010	-0.6992	***0.0340***	-1.3291	-0.0693	G
QC	Aux Mélèzes	Timing of Summer Minimum	1981 - 2010	-0.7000	0.3170	-1.0508	0.1119	N
QC	Aux Mélèzes	Timing of Winter Minimum	1951 - 2010	-0.2388	0.1921	-0.5896	0.1119	N
QC	Aux Mélèzes	Timing of Winter Minimum	1981 - 2010	1.4895	***0.0406***	1.1381	0.1158	G

Table A6 (continued)...

Province	Station Name	Test	Period	Slope	p-value	LCL	UCL	Normal or Gamma
QC	Bell	Timing of Spring Maximum	1951 - 2010	-0.2255	***0.0332***	-0.4264	-0.0246	N
QC	Bell	Timing of Spring Maximum	1981 - 2010	-0.2615	0.2810	-0.5116	0.1477	N
QC	Bell	Timing of Summer Minimum	1951 - 2010	0.4897	***0.0383***	0.0230	0.9564	G
QC	Bell	Timing of Summer Minimum	1981 - 2010	0.2451	0.5015	-0.0050	0.1477	N
QC	Bell	Timing of Winter Minimum	1951 - 2010	-0.1024	0.4268	-0.3525	0.1477	N
QC	Bell	Timing of Winter Minimum	1981 - 2010	-0.1192	0.5515	-0.3694	0.1477	N
QC	Chaudière	Timing of Spring Maximum	1951 - 2010	-0.0895	0.3125	-0.2618	0.0828	N
QC	Chaudière	Timing of Spring Maximum	1981 - 2010	0.0961	0.6496	-0.2551	0.2137	N
QC	Chaudière	Timing of Summer Minimum	1951 - 2010	0.1842	0.3509	-0.1999	0.5683	N
QC	Chaudière	Timing of Summer Minimum	1981 - 2010	0.6064	0.3648	0.2553	0.2137	N
QC	Chaudière	Timing of Winter Minimum	1951 - 2010	-0.1374	0.4461	-0.4886	0.2137	N
QC	Chaudière	Timing of Winter Minimum	1981 - 2010	0.0128	0.9828	-0.3383	0.2137	N
QC	Chicoutimi	Timing of Spring Maximum	1951 - 2010	-0.2599	***0.0069***	-0.4419	-0.0780	N
QC	Chicoutimi	Timing of Spring Maximum	1981 - 2010	-0.1812	0.5017	-0.7890	-0.1863	N
QC	Chicoutimi	Timing of Summer Minimum	1951 - 2010	-0.4667	***0.0366***	-0.9072	-0.0263	G
QC	Chicoutimi	Timing of Summer Minimum	1981 - 2010	0.1253	0.8502	-0.4825	-0.1863	N
QC	Chicoutimi	Timing of Winter Minimum	1951 - 2010	-0.7941	***0.0130***	-1.4019	-0.1863	N
QC	Chicoutimi	Timing of Winter Minimum	1981 - 2010	1.4463	0.1237	0.8385	-0.1863	N
QC	Des Prairies	Timing of Spring Maximum	1951 - 2010	0.0382	0.7481	-0.1936	0.2699	N
QC	Des Prairies	Timing of Spring Maximum	1981 - 2010	0.2722	0.5728	-0.4071	0.4266	N
QC	Des Prairies	Timing of Summer Minimum	1951 - 2010	0.1426	0.1888	-0.0677	0.3528	N
QC	Des Prairies	Timing of Summer Minimum	1981 - 2010	0.0833	0.8015	-0.5960	0.4266	N
QC	Des Prairies	Timing of Winter Minimum	1951 - 2010	-0.2527	0.4692	-0.9320	0.4266	N
QC	Des Prairies	Timing of Winter Minimum	1981 - 2010	0.8233	0.6292	0.1440	0.4266	N
QC	Eaton	Timing of Spring Maximum	1951 - 2010	-0.0524	0.6541	-0.2805	0.1756	N
QC	Eaton	Timing of Spring Maximum	1981 - 2010	0.3266	0.3037	-0.0571	0.3599	N
QC	Eaton	Timing of Summer Minimum	1951 - 2010	0.2930	0.1744	-0.1245	0.7104	N
QC	Eaton	Timing of Summer Minimum	1981 - 2010	0.6389	0.2808	0.2552	0.3599	N
QC	Eaton	Timing of Winter Minimum	1951 - 2010	-0.0238	0.9036	-0.4075	0.3599	N
QC	Eaton	Timing of Winter Minimum	1981 - 2010	-0.0509	0.9244	-0.4346	0.3599	N
QC	Grande rivière de la Baleine	Timing of Spring Maximum	1951 - 2010	-0.3603	***0.0085***	-0.6156	-0.1050	N
QC	Grande rivière de la Baleine	Timing of Spring Maximum	1981 - 2010	-0.0801	0.7756	-0.3035	0.3451	N
QC	Grande rivière de la Baleine	Timing of Summer Minimum	1951 - 2010	-0.2128	0.3807	-0.6834	0.2578	N

Table A6 (continued)...

Province	Station Name	Test	Period	Slope	p-value	LCL	UCL	Normal or Gamma
QC	Grande rivière de la Baleine	Timing of Summer Minimum	1981 - 2010	-0.1427	0.7819	-0.3661	0.3451	N
QC	Grande rivière de la Baleine	Timing of Winter Minimum	1951 - 2010	0.1217	0.2922	-0.1016	0.3451	N
QC	Grande rivière de la Baleine	Timing of Winter Minimum	1981 - 2010	0.2121	0.4095	-0.0112	0.3451	N
QC	Harricana	Timing of Spring Maximum	1951 - 2010	-0.0296	0.6126	-0.1437	0.0844	N
QC	Harricana	Timing of Spring Maximum	1981 - 2010	-0.2502	0.1818	-0.4847	0.0599	N
QC	Harricana	Timing of Summer Minimum	1951 - 2010	0.1052	0.3963	-0.1361	0.3464	N
QC	Harricana	Timing of Summer Minimum	1981 - 2010	0.0826	0.8303	-0.1519	0.0599	N
QC	Harricana	Timing of Winter Minimum	1951 - 2010	-0.1746	0.1499	-0.4091	0.0599	N
QC	Harricana	Timing of Winter Minimum	1981 - 2010	-0.2083	0.6300	-0.4428	0.0599	N
QC	Kinojévis	Timing of Spring Maximum	1951 - 2010	-0.0686	0.5249	-0.2780	0.1409	N
QC	Kinojévis	Timing of Spring Maximum	1981 - 2010	-0.2887	0.1139	-0.6750	0.4041	N
QC	Kinojévis	Timing of Summer Minimum	1951 - 2010	0.5754	***0.0122***	0.1276	1.0233	G
QC	Kinojévis	Timing of Summer Minimum	1981 - 2010	0.3951	0.3078	0.0087	0.4041	N
QC	Kinojévis	Timing of Winter Minimum	1951 - 2010	0.0177	0.9287	-0.3686	0.4041	N
QC	Kinojévis	Timing of Winter Minimum	1981 - 2010	-0.1690	0.5433	-0.5553	0.4041	N
QC	Lac des Loups Marins	Timing of Spring Maximum	1951 - 2010	0.1094	0.7369	-0.5225	0.7414	N
QC	Lac des Loups Marins	Timing of Spring Maximum	1981 - 2010	0.6547	0.1293	0.3546	0.4895	N
QC	Lac des Loups Marins	Timing of Summer Minimum	1951 - 2010	-0.1230	0.6692	-0.6822	0.4361	N
QC	Lac des Loups Marins	Timing of Summer Minimum	1981 - 2010	-0.0928	0.8243	-0.3929	0.4895	N
QC	Lac des Loups Marins	Timing of Winter Minimum	1951 - 2010	0.1894	0.2268	-0.1107	0.4895	N
QC	Lac des Loups Marins	Timing of Winter Minimum	1981 - 2010	0.2674	0.2673	-0.0327	0.4895	N
QC	Matane	Timing of Spring Maximum	1951 - 2010	-0.1056	0.1109	-0.2336	0.0223	N
QC	Matane	Timing of Spring Maximum	1981 - 2010	-0.0064	0.9723	-0.3157	0.3388	N
QC	Matane	Timing of Summer Minimum	1951 - 2010	-0.0248	0.8788	-0.3426	0.2930	N
QC	Matane	Timing of Summer Minimum	1981 - 2010	-0.2557	0.6326	-0.5649	0.3388	N
QC	Matane	Timing of Winter Minimum	1951 - 2010	0.0295	0.8523	-0.2798	0.3388	N
QC	Matane	Timing of Winter Minimum	1981 - 2010	0.4906	0.2640	0.1814	0.3388	N
QC	Mattawin	Timing of Spring Maximum	1951 - 2010	-0.1174	***0.0404***	-0.2298	-0.0051	G
QC	Mattawin	Timing of Spring Maximum	1981 - 2010	-0.0094	0.9604	-0.3724	-0.1124	N
QC	Mattawin	Timing of Summer Minimum	1951 - 2010	0.0413	0.7730	-0.2381	0.3207	N
QC	Mattawin	Timing of Summer Minimum	1981 - 2010	0.2404	0.6190	-0.1227	-0.1124	N
QC	Mattawin	Timing of Winter Minimum	1951 - 2010	-0.4755	***0.0128***	-0.8385	-0.1124	N
QC	Mattawin	Timing of Winter Minimum	1981 - 2010	-0.8163	0.2259	-1.1793	-0.1124	N

Table A6 (continued)...

Province	Station Name	Test	Period	Slope	p-value	LCL	UCL	Normal or Gamma
QC	Moisie	Timing of Spring Maximum	1951 - 2010	-0.1921	***0.0407***	-0.3702	-0.0140	N
QC	Moisie	Timing of Spring Maximum	1981 - 2010	0.1451	0.3952	-0.2935	0.3657	N
QC	Moisie	Timing of Summer Minimum	1951 - 2010	0.2996	0.1936	-0.1449	0.7440	N
QC	Moisie	Timing of Summer Minimum	1981 - 2010	0.3670	0.4505	-0.0717	0.3657	N
QC	Moisie	Timing of Winter Minimum	1951 - 2010	-0.0730	0.7461	-0.5116	0.3657	N
QC	Moisie	Timing of Winter Minimum	1981 - 2010	0.0600	0.8604	-0.3787	0.3657	N
QC	Nicolet	Timing of Spring Maximum	1951 - 2010	-0.0615	0.6946	-0.3666	0.2435	N
QC	Nicolet	Timing of Spring Maximum	1981 - 2010	-0.0911	0.6866	-0.6573	0.4555	N
QC	Nicolet	Timing of Summer Minimum	1951 - 2010	0.0428	0.9073	-0.6738	0.7595	N
QC	Nicolet	Timing of Summer Minimum	1981 - 2010	0.5650	0.4580	-0.0011	0.4555	N
QC	Nicolet	Timing of Winter Minimum	1951 - 2010	-0.1107	0.7035	-0.6769	0.4555	N
QC	Nicolet	Timing of Winter Minimum	1981 - 2010	0.6059	0.2931	0.0397	0.4555	N
QC	Romaine	Timing of Spring Maximum	1951 - 2010	-0.2193	***0.0039***	-0.3615	-0.0771	N
QC	Romaine	Timing of Spring Maximum	1981 - 2010	0.1399	0.4511	-0.1703	0.1596	N
QC	Romaine	Timing of Summer Minimum	1951 - 2010	-0.0812	0.6137	-0.3946	0.2322	N
QC	Romaine	Timing of Summer Minimum	1981 - 2010	0.1425	0.7310	-0.1677	0.1596	N
QC	Romaine	Timing of Winter Minimum	1951 - 2010	-0.1506	0.3459	-0.4607	0.1596	N
QC	Romaine	Timing of Winter Minimum	1981 - 2010	-0.0991	0.7954	-0.4093	0.1596	N
QC	Saint-Louis	Timing of Spring Maximum	1951 - 2010	-0.0363	0.7815	-0.2905	0.2180	N
QC	Saint-Louis	Timing of Spring Maximum	1981 - 2010	0.4234	0.0648	-0.2090	0.6533	G
QC	Saint-Louis	Timing of Summer Minimum	1951 - 2010	0.1063	0.7320	-0.4976	0.7102	N
QC	Saint-Louis	Timing of Summer Minimum	1981 - 2010	0.2673	0.6478	-0.3649	0.6518	N
QC	Saint-Louis	Timing of Winter Minimum	1951 - 2010	0.0196	0.9520	-0.6127	0.6518	N
QC	Saint-Louis	Timing of Winter Minimum	1981 - 2010	-0.3647	0.5278	-0.9969	0.6518	N